ISURV: Developing a sustainability index using British History Online

Grant 16/11: JISC Digital Infrastructure Programme: Enhancing the Sustainability of Digital Collections

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Executive summary

From March 2012 to June 2013, British History Online (BHO), funded by the JISC under its 16/11 Digital Infrastructure Programme carried out an investigation into sustainability looking to uncover evaluation techniques which were sensitive to changes in perception. Beginning with a survey, it looked into what users of BHO thought about the approaches we could take, as well as the difference it currently makes to everyday lives in terms of time and associated cost saved:

- Most users feel that the site should receive central funding in spite of the current Comprehensive Spending Review, although there are significant regional variations in that view
- Nearly 95% of users feel that we should not slow down and become an archive, but instead continue to add new content
- That users trust the institute of Historical Research to run BHO
- We estimate that, per year, BHO saves UK users educated to HE level around £365,000 in travel costs, over 92,000 hours in travel time, and saves 29 tonnes of CO2.

Using a combined qualitative and quantitative approach, we found several techniques which could all be built into an existing project with a moderate level of effort, and which were sensitive to the analysis of sustainability:

- The ISURV filter can be applied to web analytics to reveal a site's position in the field based on value not performance
- The System Usability Scale can provide an easily comprehensible scoring mechanism which enables comparison of sites across completely different fields
- Analysing navigation patterns reveals the increase in potential impact from *existing* users which could be as high as 30%
- A system of rotating focus groups provide a sound method of listening for changes in the environment

Following work undertaken during the project, there were several other key findings:

- Whilst content owners believe that engaging volunteers is the most appropriate way of broadening access to local history resources, the geo-coding of historical place names is fraught using modern location databases.
- The sharing of search strategies was seen as the best way of extending usage of state and administrative sources; however, some big data methods which create network graphs and timelines also appear to improve navigation of these sources
- APIs vary significantly in their functionality and efficacy, especially with regards to text searching, - their most appropriate use may be to combine them with some big data techniques
- Whilst BHO scores above average on the System Usability Scale, that difference is modest and results from the wider digital humanities field are scant so comparison is difficult. The scale itself, however, is particularly effective at predicting the subjective rating of the user and can be split into subscales.

Identification of stakeholders

British History Online is a digital library serving users worldwide in their learning, teaching and research; its users will form the focus of this investigation. With over 250,000 unique visitors per month, this audience can safely be assumed to represent a broad range of abilities and experience and be drawn from many disciplines both within and outside higher education. We are able to directly tap this heterogeneous group from those users who have registered for a free account on BHO, which currently numbers over 50,000.

However, it was important to also ensure that other users had the opportunity to feed back as well, so appeals through existing social media channels were also planned. The results from these attempts were predicted to be disappointing (and so they proved) due to the fact that, historically, users have formed a clearer relationship with the site itself than they do with social media.

Users will form an opinion and give feedback on the site based on their own observation and experience so it is important to contact those users who have most at stake if BHO succeeds or fails in order to form the most convincing picture of current user needs. This makes a qualitative element to the initial investigation essential as quantitative statistics alone will not reflect true social reality.

When it comes to the issue of costs and who pays for upkeep, the exact choice of wording and the options available as answers will create a tension in some users if they feel like they are being led towards an answer – this means that the investigation itself may become disruptive and a substantial interval may be required to let this pass before any follow-up work is undertaken.

Users expect BHO to be up and available all of the time, ready for when they or their colleagues, students or friends need us. However, when it comes to defining our role, those users have specific needs, both as individuals and also as special interest sub-groups so drawing a consensus in opinion across a large segment of our user base will be difficult; with such a broad community, we can at most define ourselves as simply being a service provider.

The diversity of our user base will also have an upside – consulting it will maximise the range of users with varying technical skills, interest areas, types of research tasks, and disabilities. This will give the investigation a much better chance of being more able to reliably generalise its results into findings which will apply across the sector.

Initial investigation of attitudes to sustainability

To uncover where users believe the burden of sustainability lies, and identify the particular preferences of those with experience in higher education, we opted to invite BHO registrants to participate in an online survey delivered through the popular *Survey Monkey* service. We also saw an opportunity to assess the level of hidden savings in terms of time and travel cost inherent in using the service for our users and seek to generalise that across the HE sector. All of these questions are summarised in Table 1.

Table 1: research questions for initial investigation

Research area	Questions
Sustainability	• At what point on the scale between paying for academic content at the point of use through to central public funding do the majority of users lie and does that change depending on the location or educational achievements of the respondent. • Do some groups of users think that other groups of users should pay more / less than they do? • Do users think we should raise income / prices currently? • Do they trust official figures or statistics?
Savings	• In terms of time and cost, what level of saving is open to researchers who use the service? • How reliably can these figures be generalised to reflect the HE sector?

Between May 10th and June 19th 2012, the survey was open and calls from social media and invitations to BHO registered users who had been active within specific time periods were made. Links to the survey were also placed throughout the site. The response rates from different emails are summarised in Table 2.

Table 2: summary of response rates to survey invitation from BHO user base

Order	Last logged in	Sent [2012]	Count	Response	Rate
1	2009-10	May 10	7,124	758	11%
2	2008	May 15	3,332	488	14.65%
3	Jan-Apr, 2011	May 17	2,042	434	21.25%
4	May-Dec, 2011	May 21	1,580	418	26.46%
5	2006-7	May 24	10,002	977	9.77%
6	2005	May 29	7,603	694	9.13%
			31,683	3,769	11.90%

In general, the more recently the user had logged into BHO the higher the response rate. However, the appeal in emails 2–6 was slightly differently from email 1, in that it began:

'Having used and registered on British History Online in the past…'

This appears to have helped the user recall that they had registered with BHO and that we were making a request as part of an existing relationship rather than a speculative effort.

The first two questions of the survey were aimed at dividing up respondents such that filtering on UK users educated to at least degree level would be made possible (see Table 3). There were 1,272 responses from UK-based researchers educated to HE level - the audience which this investigation primarily focuses on - representing a healthy sample size from which to identify trends. Over a third of respondents were based outside of the UK, making international comparison of opinions regarding sustainability possible.

Table 3: Response by area and education level (total 3,739)

Region	Doctoral degree	Master degree	Bachelor degree	Other below degree level	A-levels or Highers	ONC / BTEC	O-level / GCSE	Other	*Total*
UK	219	436	617	385	167	61	258	210	2,353
EU-member state	59	47	37	27	10	2	12	16	210
North America	168	187	197	124	7	4	11	42	740
Australasia	28	47	82	85	20	5	17	58	342
Other non-EU state	24	23	24	11	3	0	3	6	94
	498	740	957	632	207	72	301	332	3,739

Understanding where users feel that the burden of financial responsibility for BHO lies will help inform our approach to funding over the medium term. It will also be interesting to see if there is any divergence in opinion from North America where a different funding structure is in place. The results for question 3 are summarised in Table 4.

Table 4: Who do you think should mainly be responsible for paying for British History Online? (Total 3,655)

Options for responsibility	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
Mainly the UK government	137	87	152	49	796	1,221
Mainly the Higher Education Funding Council for England	54	45	127	14	624	864
Mainly those university libraries and individuals who subscribe to premium content	61	39	203	17	396	716
Mainly the users, via advertising	85	35	235	12	487	854
	337	206	717	92	2,303	*3,655*

The first two options for responsibility could be categorised together as 'central funding' and the latter two as 'user pays'; the split is 57 to 43 overall in favour of central funding, widening to 62 to 38 for UK respondents, but reversing to 62 to 38 in favour of user pays for North America. A tradition of central funding exists in the UK, but the clear preference may also be driven by developments in the open access movement, and the wider internet where pay walls are seen more as the exception rather than the rule.

With a clear preference for central funding, but no chance in the medium term of any increase in that funding (at least in the UK), the burden of financial responsibility will inevitably move towards the user. However, the growth of open access also throws doubt on the future of using content subscriptions to boost that revenue; the combination of these two factors leaves the digital sector with very little room to operate. It may be that the sector has not been anywhere near as successful with communicating its added value in the past, such that users now feel that the costs of running these services are negligible and certainly below those necessary for a commercial service.

During many digital projects, the majority of time, effort and cost are expended pre-launch – once a service is live, it is expected that running costs will be minimal. Set against a context of services such as Gmail, Dropbox, Wikipedia or Project Gutenberg, users appear to think that, once built, large online services can be run without charge for the majority of users. With this in mind, we might expect that users would be satisfied to see BHO become a simple archive of historical material in the medium term given the current Comprehensive Spending Review taking effect.

To help form a strategy for the current challenging financial conditions, we asked users what tone of approach they thought we should follow. The results for this question are shown in Table 5 and are again split by region.

Table 5: Suppose British History Online had to choose between the following three options – which do you think it should choose? (Total 3,599)

Tone of approach	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
Increase advertising & subscription sales income and spend more on new content	173	75	380	42	1,060	1,730
Keep advertising & sales income and spending on new content at the same level	141	114	313	39	1,149	1,756
Reduce advertising & subscription sales income and spend less on new content	17	15	16	7	58	113
Total	331	204	709	88	2,267	*3,599*

Opinion on strategy was evenly split: 49 to 48 in favour of keeping site activity at its current level, widening within the UK to 51 to 47 but reversing in North America to 44 to 54. There seems to be no clear mandate for changing strategy here: as the question made explicit the two income streams from advertising and subscription sales, this may mean that users see diversification of income as the most sensible approach for sustaining digital content in an uncertain funding climate. Furthermore, whilst users consider that the burden of funding should fall centrally, they believe that commercial influences and product diversification are effective in creating a financially balanced set of conditions for sustainability.

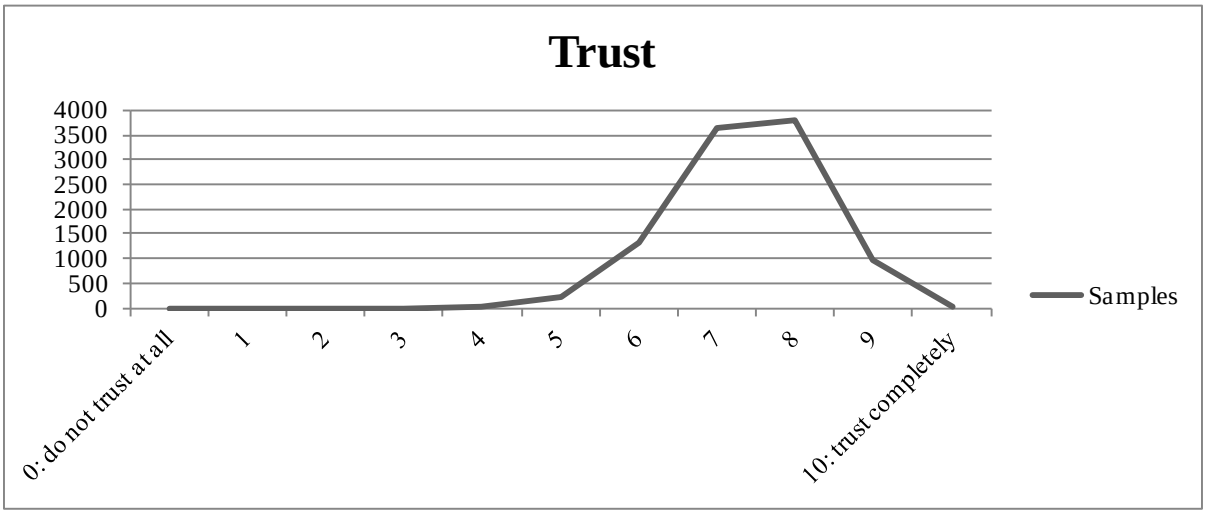
In order for an academic service to become a marketable product, it needs to reach a loyal audience who recognise its value to them. This is a difficult area to research, so we decided to ask a related question from which we could infer some level of trust in the service as a whole. The results to this question, which looked at whether users trusted us when we put out performance statistics, are given in Table 6.

Table 6: British History Online publishes statistics about how well it is doing such as the number of articles viewed and the number of visitors to the site. On a scale of 0 to 10, where 0 is 'do not trust at all' and 10 is 'trust completely', how much do you trust that these figures give a true picture of how well it is doing? (Total: 3,521)

Strategy	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
0: do not trust at all	3	0	4	1	14	22
1	1	0	2	0	7	11
2	1	0	6	1	11	21
3	6	10	15	0	31	65
4	9	3	14	2	53	85
5	42	24	126	12	347	556
6	28	19	47	9	206	315
7	59	34	100	16	376	592
8	79	42	138	19	511	797
9	34	35	99	7	269	453
10: trust completely	62	32	143	20	392	649
	324	199	694	87	2,217	*3,521*

To simplify results, we took 10,000 samples of 5 random scores and plotted the average (see Figure 1). The average trust score is 7.4 in both tables, but the median revealed by the sampling approach drops down to 7 from 8, to reflect the greater number of lower scores. Overall, the site is well trusted by its user base suggesting that the digital resource is now a key component of humanities research.

Figure 1: Graph of 10,000 means of random samples of 5 trust scores



Participants were then offered a set of reasons for why they trusted/distrusted the site and the survey split into two lists: the results for participants who had given a score or 6 or above for the previous question are shown in Table 7, and the remainder in Table 8.

Table 7: ***What is your main reason for saying that?*** **[Question 6] Shown to participants who had answered 6 or above to question 5 on trust**

Reason	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
British History Online does not have a vested interest in the results	108	64	167	21	674	1,034
Don't understand figures or statistics	20	3	27	3	82	135
Heard / read something good about the figures	9	17	20	7	90	143
The figures are easy to count or measure	50	34	132	20	455	691
Trust the figures from personal experience	34	28	91	18	213	384
Other (please specify)	34	15	80	2	212	343
	255	161	517	71	1,726	*2,730*

The most popular response, that BHO has no vested interest in the stats, suggests that users hold the site in high regard but are also not aware of stats being used to justify continuation of funding for digital resources. The second highest answer, that stats are easy to measure seems to suggest though that performance stats could be independently verified for little cost or effort. This indicates that using well-worn, common indicators of performance encourages users to be relaxed about the site due to the transparent nature of the measures themselves.

Table 8: ***What is your main reason for saying that?*** **[Question 7] Shown to participants who had answered 0-5 to question 5 on trust**

Strategy	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
British History Online has a vested interest in the results	4	5	17	3	43	72
Don't trust figures from personal experience	2	5	12	2	34	55
Don't understand figures or statistics	5	0	5	0	22	32
Figures alone do not tell whole story	38	19	91	9	261	418
Figures are difficult to count or measure	11	5	32	2	73	123
Heard \ read something bad about the figures	0	1	1	1	0	3
Other (please specify)	7	5	25	1	75	113
	67	40	183	18	508	*816*

A clear argument from those who distrust statistics put out by BHO is that they oppose performance being defined in terms of numbers alone. Thankfully it is not that they believe BHO is likely to distort statistics but rather that they expect the qualitative aspect of usage will not be reflected in stats as such – this may in turn reflect the deeper division between the use of the critical method within the humanities and the empirical approach of the social sciences.

If the participant selected the *other* option to either question 6 or 7, they had the opportunity of leaving a free-text response. Several notable themes emerge from scanning the free-text responses from participants who selected 'other' for questions 6 or 7. For those that trust BHO: firstly, that measures can be reproduced and verified easily ('*You'd be mad to make them up, when they are readily auditable!*'); secondly, that users could not believe that academic institution behind it would risk its reputation by falsifying figures ('*The academic integrity of the University of London is tied to it. My assumption is that U of L won't want to compromise their reputation by lying...don't think I'm naive - just an academic...*'), and thirdly, many users feel that they have no reason *not* to believe the figures ('*What possible reason could BHO have to doctor the figures? Not an issue.*').

For those that have a low level of trust in statistics, beyond a general distrust in statistics ('*Who trusts any government or 'official' statistics these days?*'), the risk of placing the popularity of articles above the qualitative impact of articles recurs ('*Do not like the whole idea of "statistics". Devoid of real human content*'"), as does a concern that judging statistics would require a new skill set to be learned ('*Have no means of knowing one way or another*').

The free-text sections formed the end of the first part of the survey which dealt with attitudes to sustainability; the second part of the survey, which dealt with savings accruing from digital resource usage, began with a yes/no question – only participants who responded *Yes* would go on to complete the savings section, the others would proceed to the question 14, the last in the survey. Here, 79.5% of survey respondents replied that using the site had saved them a journey.

Table 9: ***Thinking about when you have used British History Online, has it ever saved you making a journey from your home to a library?*** **[Question 8]**

Response	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
Yes	244	160	554	70	1,721	2,749
No	72	37	125	17	458	709
	316	197	679	87	2,179	*3,458*

The savings section is composed of questions 8-13, all of which are designed to work together to give you a picture of the effect BHO is having on its user base in terms of travel cost and time. The approach is sufficiently general to be re-used in evaluating the effect of other digital resources; although trips to a library may encompass consulting a wider selection of materials than BHO has, the question is still sufficiently clear to allow the participant to precisely identify trips which have been saved as a result of the content on BHO. For the final category of 'More than 20', we would go on to use a conservative numeric equivalent of 21 in our calculations.

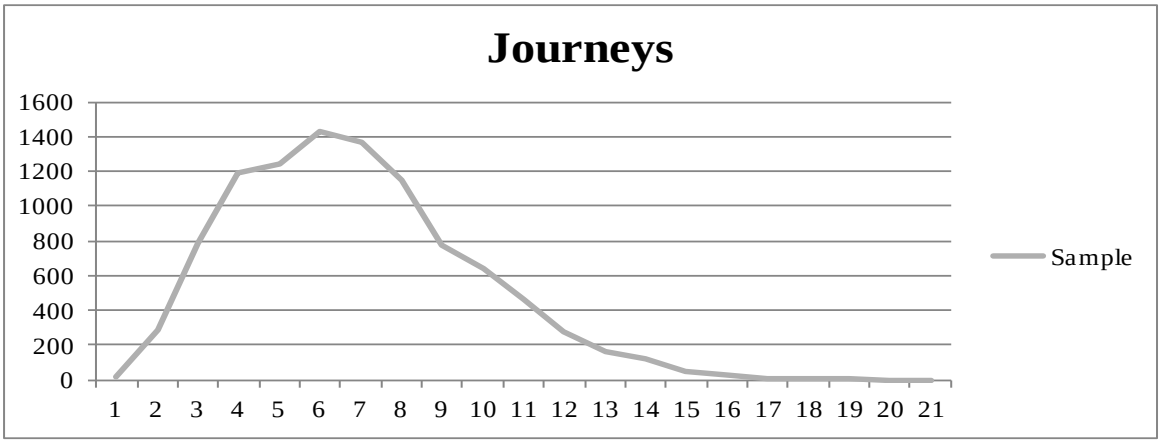
Table 10: ***Thinking about the last 12 months, how many times has using British History Online saved you making a journey from your home to a library?*** **[Question 9]**

Number of journeys saved	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
1 journey	46	24	99	9	243	421
2 journeys	30	18	74	9	257	388
3 journeys	18	15	62	6	202	303
4 journeys	13	12	45	2	148	220
5 journeys	26	17	39	5	168	255
6 journeys	16	9	39	0	118	182
7 journeys	2	1	9	1	27	40
8 journeys	8	5	13	3	39	68
9 journeys	3	2	7	1	16	29
10 journeys	15	18	44	8	173	258

11 journeys	1	1	7	1	7	17
12 journeys	11	4	21	4	70	110
13 journeys	0	0	1	0	2	3
14 journeys	0	1	1	0	5	7
15 journeys	5	4	10	1	24	44
16 journeys	1	0	4	0	3	8
17 journeys	0	0	0	0	0	0
18 journeys	0	0	2	0	2	4
19 journeys	0	1	0	0	1	2
20 journeys	6	2	4	2	14	28
More than 20 journeys (assumed 21)	23	16	53	13	171	276
	224	150	534	65	1,690	*2,663*

With a broad distribution of figures, a sampling of the data took place, revealing a peak of 6 journeys saved per user annually (see Figure 2).

Figure 2: Graph of 10,000 means of random samples of 5 numbers of journeys saved



Once the number of journeys had been calculated, we asked after the preferred method of travelling to the library which would enable further clarity to the savings calculations (see Table 11). During the survey, we had not considered the potential for representing savings in terms of CO2; however, the potential impact is possible to approximate if we know the mode of transport (see Table 17).

Table 11: How do you usually travel to the library? [Question 10]

Method of transport	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
By bus	17	16	24	12	204	273
By car / motorbike / scooter / moped	114	37	341	22	723	1,237
By train / underground / metro	42	37	52	13	263	407
By train and car	19	18	41	5	139	222
Cycling	1	6	8	3	41	59
On foot	31	36	68	10	320	465
	224	150	534	65	1,690	*2,663*

Whilst car/motorbike is the most common method overall, train or bus are used by a quarter of UK respondents, and the significant number of participants able to walk to their library may reflect their current status as researchers, lecturers or students. Calculating the distance travelled will permit an analysis of the cost of road travel (see Table 12). In this instance, we will focus on UK fuel costs and filter respondents for those from the UK (n=718) because fuel costs and consumption rates will differ between countries; for instance, US fuel prices are less than half those of the UK[1] but their fuel economy rate is likely to be inferior.

[1] US Energy Information Administration, Weekly Retail Gasoline and Diesel Prices, 2012: USD 3.610 per gallon

Table 12: ***If you were to travel to the library by car, how many miles would you drive to get there and back?*** **[Question 12]. Filtered for UK respondents who had selected 'By car / motorbike / scooter / moped' on Question 10.**

Distance to library (miles)	Estimate of miles	By car / motorbike / scooter / moped	Distance travelled (miles)	Fuel cost per journey (miles ÷ miles per gallon, × cost per gallon) [2,3]	*Annual fuel cost to user based on 6 journeys*
under 2	1	40 (5.57%)	40	£0.01	£0.03
2-5	2	167 (23.26%)	334	£0.02	£0.13
5-10	5	151 (21.03%)	755	£0.13	£0.80
10-20	10	160 (22.28%)	1,600	£0.53	£3.19
20-30	20	70 (9.75%)	1,400	£2.13	£12.78
more than 30	31	130 (18.11%)	4,030	£5.12	£30.70
		717		£ 1.32	£ 7.94

For train or metro travel, the same methodology is applied to analyse the cost of rail travel. Again, we will limit respondents and cost assumptions to the UK to prevent any misleading analysis due to cross country variations (n=244).

Table 13: ***If you were to travel to the library by train, what would be the current cost of a return rail ticket?*** **[Question 13]. Filtered for UK respondents who had selected 'By train / underground / metro' on Question 10.**

Rail ticket cost	By train / underground / metro	Cost per journey	*Annual rail fare cost to user based on 6 journeys*
under £5	51 (20.9%)	£-[4]	£-
between £5-£10	74 (30.33%)	£5.00	£30.00
between £10-£20	46 (18.85%)	£10.00	£60.00
between £20-£30	28 (11.48%)	£20.00	£120.00
more than £30	45 (18.44%)	£31.00	£186.00
	243	£ 16.50	£ 99.00

To this point, road and rail costs have been calculated using the sample average of 6 journeys; having filtered the data for UK respondents, we can now use the exact numbers of journeys given by respondents and use that to calculate the average cost per user of journeys to libraries which BHO has saved (see Table 14).

Table 14: travel cost saved by using British History Online

Method of transport	Detail	Number of users	Users as % of whole	Number of journeys	Cost per journey	Total cost	Cost per user
By train / underground / metro		244	14.63%	1,681		£18,928.00	£77.57
	under £5	51	3.06%	402	£-	£-	£-
	between £5-£10	74	4.44%	473	£5.00	£2,365.00	£31.96
	between £10-£20	46	2.76%	278	£10.00	£2,780.00	£60.43
	between £20-£30	28	1.68%	235	£20.00	£4,700.00	£167.86
	more than £30	45	2.70%	293	£31.00	£9,083.00	£201.84
By car / motorbike / scooter / moped		720	43.17%	4,876		£4,017.52	£5.58
	under 2 miles	40	2.40%	214	£0.00	£0.64	£0.02
	between 2-5 miles	169	10.13%	934	£0.01	£11.14	£0.07
	between 5-10 miles	151	9.05%	990	£0.07	£73.78	£0.49
	between 10-20 miles	160	9.59%	1,141	£0.30	£340.15	£2.13
	between 20-30 miles	70	4.20%	588	£1.19	£701.16	£10.02
	more than 30 miles	130	7.79%	1,009	£2.86	£2,890.66	£22.24
By train and car		139	8.33%	937	£-	£-	£-
By bus		204	12.23%	1,409	£-	£-	£-
Cycling		41	2.46%	300	£-	£-	£-
On foot		320	19.18%	1,899	£-	£-	£-
		1,668				£22,945.52	£13.76

[2] Average MPG: 33. Table 11: Revised CO2 emission factors for cars by engine size for 2011 update, Methodology Paper for Emission Factors, DEFRA

[3] Average UK pence per gallon: 601. AA Fuel Price Report July 2012

[4] Assuming that the cost is covered under a form of travel season ticket which the user otherwise has

In addition to financial cost, users face a further cost in terms of the time taken to travel to libraries. Not all of this time is necessarily unproductive - considerable work can be done if the participant is travelling by train or even bus; nevertheless, the working conditions are unlikely to be predictable or fully useable for academic work.

Table 15: ***About how much time does it usually take for you to get to the library?*** **[Question 11]**

Strategy	Australasia	EU-member state	North America	Other non-EU state	UK	*Total*
under 5 minutes	18	5	40	4	75	142
between 5-15 minutes	45	17	135	8	368	573
between 15-30 minutes	47	46	169	13	517	792
between 30-60 minutes	55	28	80	19	419	601
between 1-2 hours	17	19	45	6	190	277
more than 2 hours	42	35	65	15	121	278
	224	150	534	65	1,690	*2,663*

With a broad distribution of figures, a sampling of the data took place, revealing a peak of 15-30 minutes (see Figure 3).

Figure 3: Graph of 10,000 means of random samples of 5 journey times

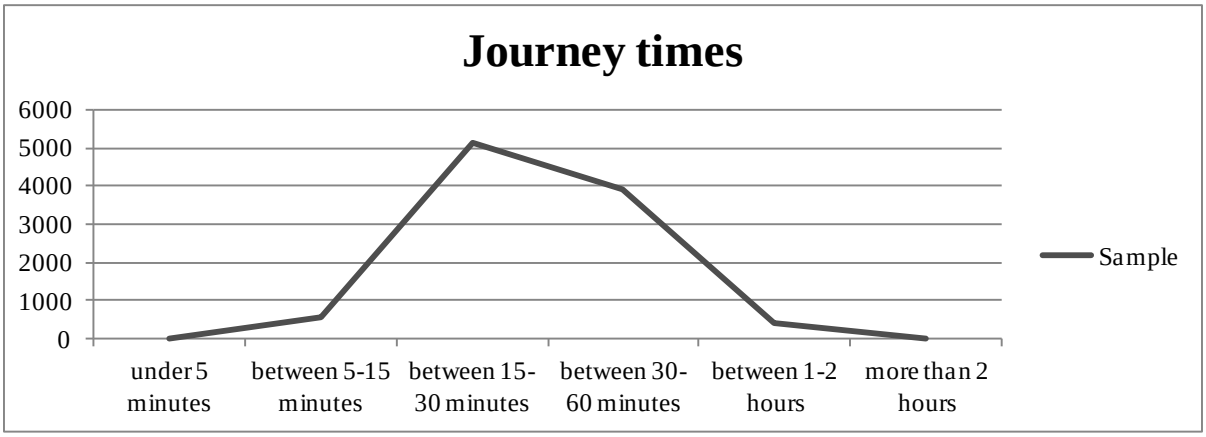


Table 16: travel time saved by using British History Online (UK respondents)

Duration of journey	Number of users	Number of Journeys	Total time saved (minutes)	Total time saved per user per year (minutes)
under 5 minutes	75	438	438	5.84
between 5-15 minutes	370	1,917	9,585	25.91
between 15-30 minutes	517	3,396	50,940	98.53
between 30-60 minutes	419	3,059	91,770	219.02
between 1-2 hours	190	1,522	91,320	480.63
more than 2 hours	121	903	108,360	895.54
	1,692	11,235	352,413	208.28

Using this calculation, we arrive at an average figure of 208 minutes (3h, 28m) saved in travel time per user per year by using BHO. This could be related to a cost per hour based on a benchmark salary; however, it is not possible to tell from the survey whether the journeys would have taken place in the line of work.

It is also possible to combine mode of transport with the number of journeys saved to enable an analysis of CO2 savings. Each institution will have its own specific environmental targets and whilst it is unlikely that the users of digital resources will fall under that definition, especially given their international and non-academic distribution, there will nevertheless be a positive effect on CO2 emissions proportionate to the amount of usage the resource receives, and the reporting at the resource-level is the only place where that saving can be estimated.

Table 17: CO2 saved by using British History Online (UK respondents)

Mode of transport	CO2 emissions (kg per mile)	Number of users	Number of Journeys	Distance (miles)	Total CO2 saved (kg)	CO2 saved per user per year (kg)
By train / underground / metro	0.1	261	1,770	4,795	479.5	1.84
Car / motorbike / scooter / moped[5]	0.1	720	4,876	8,163	816.3	1.13
By train and car	0.1	135	920	2,774	277.4	2.05
Bus	0.2	204	1,409	1,291	258.2	1.27
Cycling	-	41	300	220	-	-
On foot	-	315	1,891	754	-	-
		1,676	11,166	17,997	1,831	1.09

In hindsight, our calculations could have been more precise if the 'car / motorbike / scooter / moped' option had been split into its constituent elements; as a result of them being grouped, we have used a conservative estimate of 100 grams of CO2 per mile travelled. The calculation reveals a saving per user of 1.09 Kg of CO2 per year from using BHO.

Finally, respondents were asked if they'd be happy for their response to be followed up, an indicator of whether the survey topics were relevant to them and they had more time to spare; 19% entered their email address to signal assent.

Summary of initial investigation

To recap, the average savings in travel per year for a user of BHO is £13.76 in fares/fuel, 1.09Kg of CO2 and 208 minutes. From this, we can extrapolate a headline figure looking at annual total savings for UK users educated to HE level. This begins with the number studying history at undergraduate level in one year[6], the proportion retaining an interest in their studies, life expectancy following graduation, and some method of normalising this information over a number of years to reflect the growth in the study of history and of degree-level qualifications over the past 20 years.

To calculate the number of users who remain interested in the subject after their studies end, we first look at the number which go on to study the subject at postgraduate level which in 2011 amounted to almost 30%. It is fair to assume that the number of those who still remain interested in the subject is higher than that given that many will not be in a position to continue studying. On the other hand, BHO does not have many 20th century materials or pre-medieval sources, so it is unlikely to appeal to all those across the field; however, it does contain many of the central works in between those periods. On balance, a figure of 10% was chosen as the proportion of users to whom the resource would continue to be of regular use.

Assuming that the age of graduation was 24 (a lower figure of 22 may be more accurate in recent times[7]), an average life expectancy of 80 (78 for males, 82 for females[8]) leaving 56 years' worth of students educated to at least undergraduate level alive at any one point. The current number of graduates has appreciated sharply over the last two decades; those studying history in the earliest figures available from the Higher Education Statistics Authority (HESA) numbered 26,885 in 1996/97[9]; by 2011/12, that figure had more than doubled to 56,200[6]. To normalise numbers over the 56 years, we will reduce annual students by 7% per annum for the first 15 years, then 2% per annum thereafter to reflect a gentler rise in HE take-up prior to the 1990s. This approach is summarised in Table 18, showing annual savings in direct costs to those educated to HE level in the UK of £365,988, plus 92,206 hours of travel and almost 29 tons of CO2 emissions avoided.

[5] Average CO2 emissions per mile. Motorbike: 0.1Kg; Car: 0.2Kg. Methodology Paper for Emission Factors, 2011. DEFRA https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69314/pb13625-emission-factor-methodology-paper-110905.pdf

[6] Full and Part Time undergraduate, first degree, first year ('History by area', 'History by topic', 'History by period'), HESA students by subject 2011 http://www.hesa.ac.uk/content/view/1897/239/

[7] Table X1.1c., p. 469, OECD Education at a glance 2011, http://www.oecd.org/education/highereducationandadultlearning/48631582.pdf

[8] Life Expectancies 2011, UK National Statistics, http://www.statistics.gov.uk/hub/population/deaths/life-expectancies/

[9] Total HE Students studying History, Table 2e - All HE students by Subject of Study, Domicile and Gender 1996/97, HESA http://www.hesa.ac.uk/index.php/content/view/1973/239/

Table 18: calculation of annual savings to Higher Education

Code	Description	Value
A	Number studying history, first year, first degree, undergraduate	14,825
B	Assumed interested in BHO after graduation	10.00%
C	Assumed lifespan following graduation (years)	56
D	Sum of history graduates (normalised)	265,980
E	UK HE benefitting from BHO [B × D]	26,598
F	Average travel cost savings per user	£13.76
G	Travel time saved per user per annum (minutes)	208
H	CO2 emissions saved per user per annum	1.09
	Total travel cost saved per annum [E × F]	£365,988.48
	Total travel time saved pa (hours) [E × G]	92,206
	Total travel CO2 saved pa (kg) [E × H]	28,992

To give some context, during 2012, there were over 2.6m visits to the site from users located in the United Kingdom. Filtering this data further for visits which led to more pages downloaded than average (5) still results on over 383,000 visits over 2012. This is well in excess of the number estimated in row E which, if multiplied by the average number of journeys taken (6), would still only amount to half of the above average use recorded by Google Analytics.

On June 20th 2013, BHO was officially 10 years old; from the analysis presented above, we can conclude that BHO has made and is continuing to make a considerable practical impact on the work patterns of UK-based researchers educated to HE level.

Uncovering enhancements

During analysis of the results from the initial benchmarking exercise, there was by no means a consensus among users that they would be happy to see an expansion of commercial activity on the site, whether through advertising or content subscriptions. If the amount of advertising and cost of subscriptions must remain at their current level, then all we can do is increase usage, and rely on more usage yielding more revenue at the current earnings rate.

The content of BHO splits roughly into two themes: topographically arranged accounts of local history (e.g. The Victoria County History, the Survey of London) and state / parliamentary papers (e.g. Journal of the House of Commons, State Papers Domestic). Although users do cross between these two general types, over 95% of visits will include one but not the other; therefore, in selecting enhancements to cover in this project, we considered it important to look at improving access to both of these types of sources.

It seemed logical that adding some kind of geo-coded service to the local history resources and some method of analysis to the structured albeit diverse data from the state sources would suit the sources best. Given that we were looking to increase usage, we arranged two focus groups made up of key opinion-formers in the fields to uncover as best as possible what users are frustrated at not being currently able to do and see what they think would work.

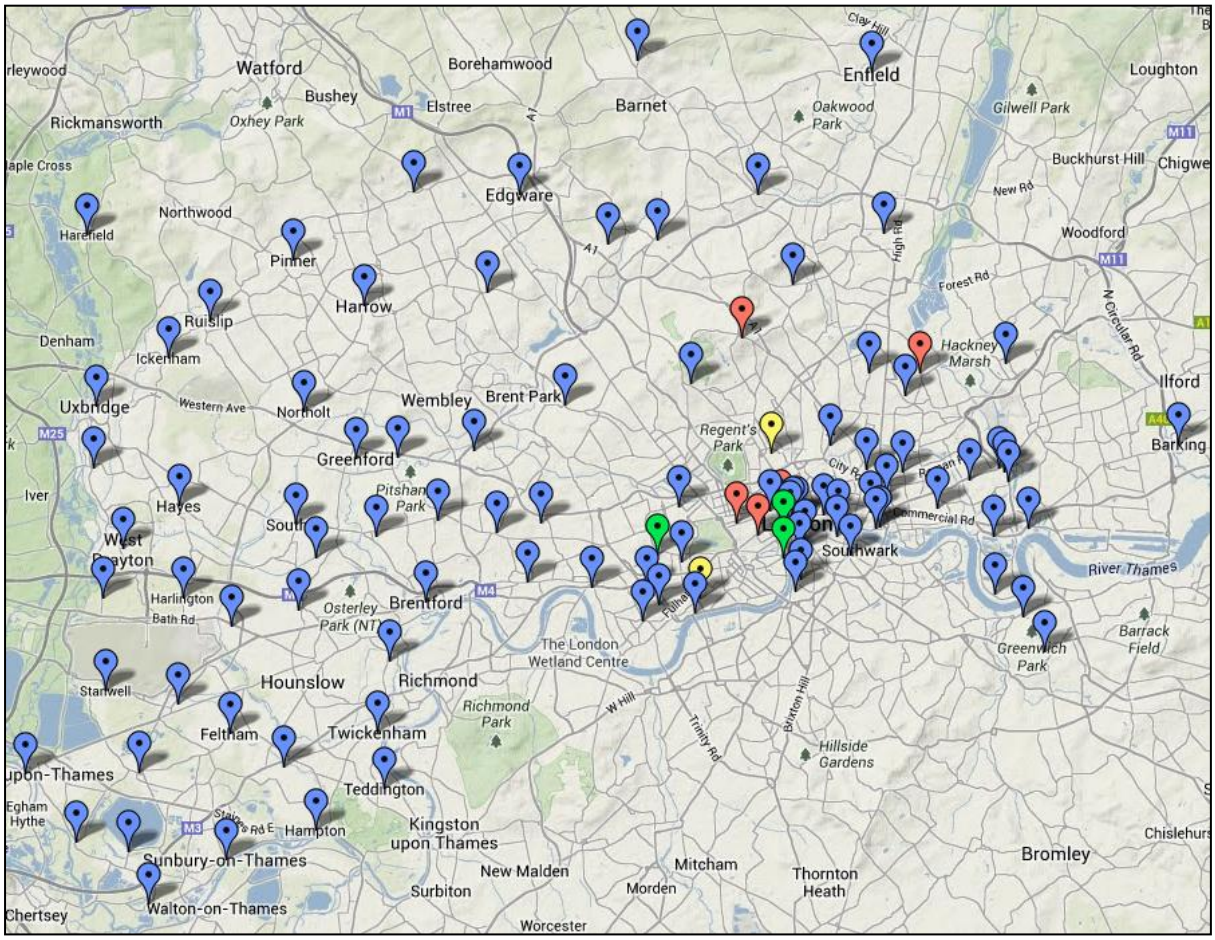
Focus group 1: local sources

Attended by Justin Colson (postdoctoral scholar), David Kroll (postdoctoral scholar), Philip Temple (Survey of London, English Heritage), Colin Thom (Survey of London), Aileen Reid (Survey of London), and Matthew Bristow (Victoria County History); moderated by Bruce Tate (Institute of Historical Research).

This group was concerned with the creation of a GIS-based method of finding articles on British History Online. By focussing on London resources, the group aimed to uncover a solution using the most diverse range of overlapping resources on the site, and would also consider the issue of sustainability in this context. A draft Google Map was presented to begin discussion showing selected BHO resources for London[10].

[10] https://maps.google.co.uk/maps/ms?msa=0&msid=201440928035646855583.0004bea988b21665567b0&ie=UTF8&t=p&ll=51.544627,-0.219727&spn=0.341623,0.714798&z=11

Figure 4: Google map showing selected BHO publications for London



Following discussion, the group generally agreed a set of stages whereby content could be incrementally geo-coded and released:

- Version 1: link every topographically-structured publication to a nationwide list of parishes using parish church. Clicking on a publication pin shows its navigation map (where available).
- Version 2: link chapters within every topographically-structured publication to individual locations. Thematic or overview sections within a publication may be indicated with a different style of icon.
- Version 3: link photographs and plate sections within every topographically-structured publication to individual locations.

Options would need to be looked at for how volunteers could be brought into the process to help with some of the geographical indexing. Local history groups were thought to contain the ideal blend of knowledge of the local area and commitment to getting it right. The British Association of Local Historians was also suggested as a way of moving the process into areas where we have fewer contacts. The 'Who Do You Think You Are Live' exhibition, held in Feb/Mar each year, was suggested as an effective way of canvassing for volunteers.

It was felt that this would suit users whose queries are topographically based and who may be put off by long lists of publications. However, the group was also concerned at the amount of quality assurance effort that would be required from the larger scale of work required. This could be partially offset if the contributors identified earlier could be kept engaged within the project.

Moderator's reflection

Content owners accept that the quantity of metadata required for indexing resources by place is so large that it can only reasonably be delivered by engaging volunteers. However, beyond a few enthusiastic adopters, crowd

sourcing has little traction within the existing field of local groups of historians, possibly because of the technical barriers but also due to the lack of an incentive, or even just awareness.

This could be addressed by creating an iOS, Facebook or Android app aimed at using the GPS chip in devices to ask users to help find and identify resources in BHO as specifically relating to a particular place. If it could be combined with a taxonomy of place names with national coverage, then users could be asked questions about resources which are specific to their surrounding area, potentially making for a more relevant product which may provoke an interest in the local area.

Focus group 2: State sources

Attended by Ben Coates (History of Parliament Trust), Sean Cunningham (The National Archives), Aleks Drozdov (The National Archives), and Katy Mair (The National Archives). Moderated by Bruce Tate (Institute of Historical Research).

This group looked at the creation of several functions to better support usage of the calendars of state papers on BHO. By focussing on the calendars, the group aimed to uncover solutions using a more editorially consistent set of resources than the original manuscripts themselves, and would also consider the broad issue of sustainability.

Several candidate developments were produced prior to the focus group and presented at the meeting with the aim of initiating discussion. The first candidate for development demonstrated a network diagram of how often one term appeared with other terms in the same context over a whole book, whilst another focussed on finding terms within a page.

Figure 5: Network Diagram of co-occurring terms from parliamentary source with indication of strength

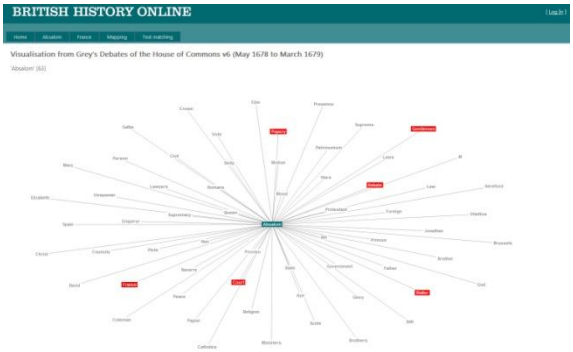
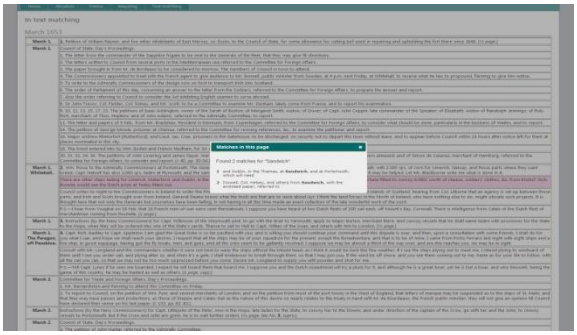


Figure 6: modal window showing in-page matches with links thereto



Following discussion, the group agreed on several developments which would specifically enhance querying of state sources:

- Development 1: enable the simple matching of single or multiple terms contained in each section of a sample calendar to find those unknown other terms which occur most often with them.
- Development 2: enable links to the TNA catalogue for sample calendar and report on ease of reference conversion. Secondly, consider the possibility of linking to third parties which have transcriptions of the papers themselves.
- Development 3: monitor the field for other taxonomies which would help researchers build better queries.[11]

[11]TNA are contributing to the Family Names in the United Kingdom project at UWE; the output from this, combined with that of the Digital Exposure of English Place-Names (DEEP) project at King's would make useful additions as a pre-processing service for searching.

- Development 4: enable the above functions across all calendars.
- Development 5: create a digest of the different sources used to construct a page's worth of calendar entries, giving users a clearer idea of its source/provenance.

There was little discussion of marking up data or improving metadata; mostly, the group focussed on search strategies and wanted sometimes very difficult queries to be more easily managed so they could be returned to later, or perhaps shared. If these queries could be objectified, then their efficacy could be examined with respect to individual calendars or whole series where the editorial style could vary significantly.

This stratum of use, bookmarking of saved searches, appears at the moment to be limited to private / personal applications such as browser favourites or the Zotero extension. However, if users are to get more out of the sources, then it makes sense to provide a stable of worked queries which illustrate the limits of the source. Furthermore, it is possible that correspondence could appear in one series and replies could appear in another, so some flexibility in illustrating temporal queries across sources might reveal further linkages and prompt deeper use.

Moderator's reflection

Users accept that the era of the printed calendar is now over and that digital adaptation is the only way forward, a view which is supported by initiatives such as the Open Government Licence. Beyond making images and content available, service provision should now move carefully into the area of search support, looking at helping users construct queries which better suit the sources. An important element to this approach is choosing and integrating taxonomies and thesauri (for instance, lists of alternate place names, medieval translations, even references from The National Archives), which will allow the user to more reliably query a source with which they are unfamiliar.

Furthermore, research appears to be justified into the application of several techniques used under the umbrella term of 'Big Data'. Mapping the incidence of terms over time, sometimes across series, and the terms with which they co-occur, opens up the possibility of systems being able to proactively identify and suggest potential themes for research. This will create a need for new methods of data storage and retrieval, potentially those provided by NoSQL solutions.

How will we deliver enhancements

Framework of sustainability

According to the manifesto of the Agile software movement[12], there are several principles for software development which will promote a lightweight and evolutionary approach. They have been reproduced here along with an interpretation of how they could be applied:

Individuals and interactions over processes and tools

Collaboration on projects is essential to get the most of different users' experience; team should be made up of the complete skill set required to serve their user base, i.e. technical, editorial, communications, and they should interact without constraint (i.e. in a way that comes naturally, not wholly via email or a bespoke communications system), and largely in person.

Conclusion: Impact reporting should include indicators which show problems solved, not production benchmarks. Focus groups will be used to bring users directly into the development stage and should be moderated by more than one staff member. Developments should be announced through social media channels to enable sharing.

[12] http://agilemanifesto.org/principles.html

Working software over comprehensive documentation

There is greater return in spending more effort on creating software than accompanying paper documentation. This point emphasises the practical process of innovation / creation rather than the ceremonial process of documentation. In addition, automatic testing can be integrated into each chunked software output leading to an ongoing process of quality assurance.

Conclusion: documentation should be practice-oriented and focussed on helping users and developers to understand the service[13]. Software should be released in a modular form with steady progress so that quality assurance is an ongoing process. Integrate performance data and feedback from social media channels on earlier developments in later stages.

Customer collaboration over contract negotiation

The software developer's biggest challenge is to understand the problems their user base encounters – a better knowledge of that will result in the developer creating more relevant output. However that is managed (e.g. focus groups, surveys, usability tests), those needs are liable to change and the creation of a new software product may itself be disruptive and alter them further. This makes constant user/customer collaboration over the course of the development essential for project success. Projects should only need to create a framework of regular customer interaction at the outset rather than a set of fixed deliverables. This spreads out the impact of the project and, in addition to the main delivered software, impact can also be measured on those other incremental functions as well.

Conclusion: ensure that there is qualitative and quantitative feedback from each software output which is accessible to the whole team; that mechanism ought to be clear and open, potentially through a social media channel, to expose as much of the conversation as possible which will make the users feel like they're being listened to and think of the project as transparent.

Responding to change over following a plan

With a traditional project view, a plan for software development can take a considerable period of time to complete, resulting in the value of software being locked in until the final pieces of software are ready. Outside of this project-oriented view, a *product* focus would allow developers to build specific pieces of functionality in stages with a view to releasing them incrementally.

Conclusion: the details of plans can be left until the last moment such that positive changes in value, cost or schedule can be implemented, potentially sourced from feedback on earlier iterations – this means a continuous form of (re-)planning will be more beneficial in the future.

Applying the principles

The smaller the interval between feedback loops then the clearer will be the definition of what is being developed between those reports. This means that feedback can be returned faster and create an impression of a responsive development process. This will make it easier for the definition of a team to extend to senior owners and other functional specialists; a more engaged team will help with a creative activity such as designing an information system.

Operating within the non-profit environment, the project needs to continuously deliver impact which can be measured and reported, even if that impact is subjective and held by users. Survey methods need to exist which can quickly verify and report the impact which new developments have, both quantitatively and qualitatively, so that developers can get feedback. This may mean splitting projects into (fully formed) development 'slices'.

By establishing some new feedback channels (such as the System Usability Scale), and using existing ones (such as log files), the project will have a range of information sources to hand, enabling them to anticipate problems.

[13] Support material was created for the text mining tools: http://www.british-history.ac.uk/support/help-analysis.aspx

If a usability failure is detected, then beyond a direct remedy to the system itself, managers will be able to consider whether the project's effectiveness was influenced by its particular working practice.

Discussion of what enhancements were made

The survey threw up a straightforward question of whether we could simply increase the amount of usage on the site; we needed to check how to deliver that goal using well-founded research from focus groups. Users also felt that project costs were comparatively negligible following launch; however, if services are to continue to grow, then persistent funding is necessary to continue innovating. So we decided to look at the issue of financial sustainability through adding an appeal for donations to help us grow; Wikipedia had been consistently successful with their funding campaign[14] which runs in autumn of each year and that their model provided many insights for best practice.

Using focus groups to compile priorities adds considerable weight to the development objectives, as it makes them clear, broadly understood and urgent. In the case of local history sources, we planned to investigate geo-coding resources on BHO and making that data available for re-use. From the state sources group, we will look at whether the application of several big data methods will result in the adoption of new methods of questioning of resources.

Text mining

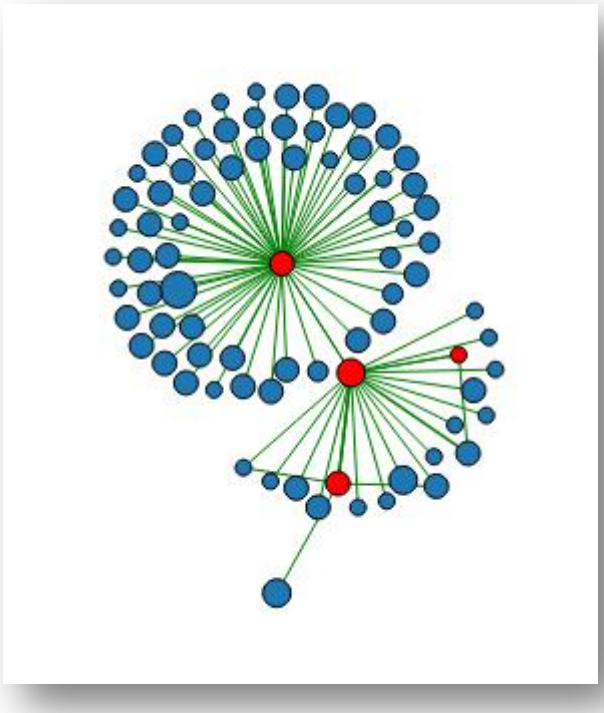
As of June 2013, there were over 1,050 separate resources on British History Online, containing 363 million words. Whilst searching this corpus remains the most popular research technique, users often need to enter multiple search terms, and navigate through numerous long documents to determine any connections. A set of three text mining tools were constructed so as to counteract this burden - they make up a series of methods through which the user can have connections presented to them without the repetitive effort of searching and navigating.

Network of people

This tool allows users to see how often personal names appear within a volume, and whom they most often appear with; for example a search for the name *Pawlett* in the Commons Journal of 1646-8 reveals four individuals who are connected with about 50 other people. These numbers and connections are then visualised using a network diagram.

[14] http://wikimediafoundation.org/wiki/Press_releases/Wikimedia_Foundation_raises_25_million_in_2012_fundraiser

Figure 7: network diagram showing who appears in the same context for the search 'Pawlett'. Mouse-over reveals names, size of circle reveals the number of overall occurrences in volumes and line thickness shows degree to which they overlap [15]



State paper and parliamentary sources contain the most names, and their format is largely predictable so they were prioritised for development. The first part of the process was to build up a pattern of personal names as they appear in the source – this is likely to be context-specific so knowledge of editorial style is essential. For instance, there are multiple titles which may optionally prefix personal names, such as: *Mr, Mrs, Dr, Doctor, Sir, Lord, Colonel, King*; there may also be many suffixes, such as: *Esquire, Gentleman, Defendant, Knight*.

Each document within a specific volume is checked for the presence of one of our dictionary terms. The processing time taken will be affected by the number of documents, their length and the number of items in the dictionary. For volume 5 of the Journal of the House of Commons (which covers 1646-8), there were over 25,000 instances of 6,942 different personal names from our dictionary.

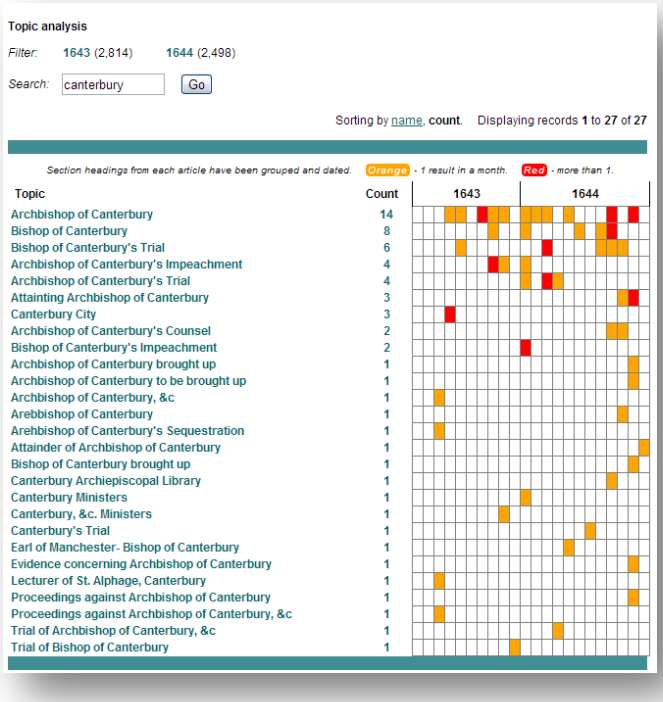
Once we know which terms appear in which documents, we can calculate the frequency with which each name appears firstly over the whole publication, and secondly, how often they overlap with all other names from the dictionary. By ordering people by the number of times they appear with others, we can add a degree of significance to the relationships within the network.

Headings by date

This tool allows users to search the headings in state and parliamentary sources, and have them presented as a timeline. For example a search for *Canterbury* in the Commons Journal of 1643-4 reveals the discussions around the trial of Archbishop Laud. These headings and document counts are then visualised using a timeline device.

[15] http://www.british-history.ac.uk/analysis.aspx?p=110&t=p&i=&k=Pawlett&s=n

Figure 8: timeline showing discussions around the trial of Archbishop Laud, 1643-4



State paper and parliamentary sources bring together information on a diverse range of subjects such as social, economic, legal and religious affairs plus foreign policy. Each discussion has a heading; however, there are inconsistencies in style so users have to always try a range of search strategies before they can be sure they have everything on a certain subject.

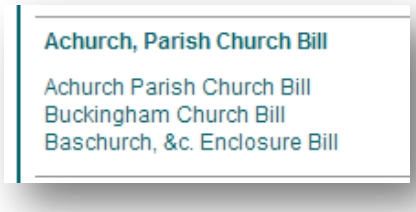
Each heading from each document is extracted and de-duplicated along with a count of the number of articles in which it appeared. By using the date which is associated with the original document, we can produce a timeline of how often each heading appears in a particular volume (see Figure 8).

Heading similarity

This tool allows users to draw together a list of similar spellings starting from a single term. With so many sources, and variable standardisation of the spellings of entities such places, names or bills, a user could well miss out on potentially valuable materials and connections if they do not employ search terms which are appropriate to the source.

Figure 9: given a heading "Abp. Canterbury's Estate Bill", show other headings which require the fewest number of letters to be changed to transform one heading into another

Figure 10: most similar headings to "Achurch, Parish Church Bill"

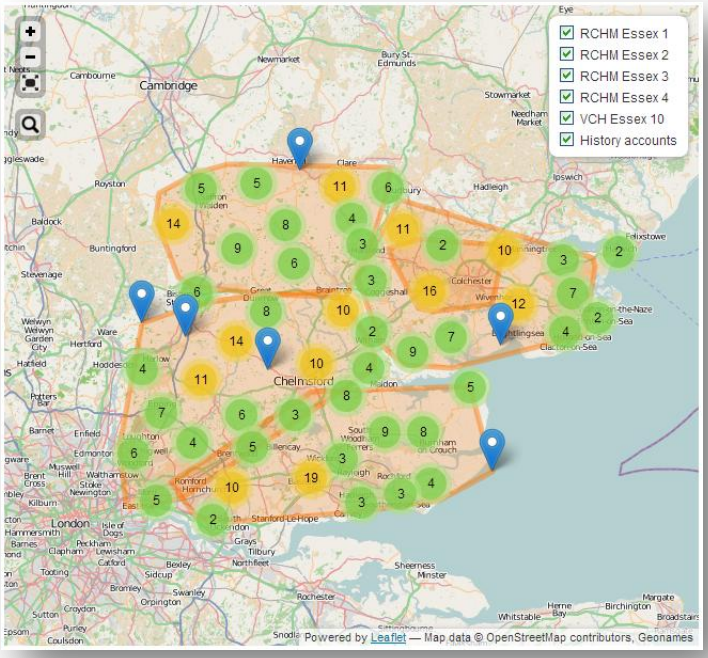


For each pair of headings, the Levenshtein distance is calculated between the two terms and used as a proportion of the length of both terms. Only those relationships which are higher than the average plus twice the standard deviation are reported on. In Figure 9, the tool correctly suggests that the term *Abp* could be expanded to *Archbishop* (and vice versa). Note how the third entry, *E. Shrewbury's Estate Bill*, shares many of the letters in the correct order as the main term.

Mapping

This tool enables users to navigate easily between geo-located materials which are near to each other without having a prior knowledge of the layout of a particular area/county nor knowing the coverage of the sources on BHO. In addition, by using a gift-wrapping algorithm, the coverage of any particular volume can be instantly shown, visually demonstrating how series of publications (such as the Royal Commission for Historical Monuments in England) are structured, and potentially introducing sources which the user would not otherwise have sought out.

Figure 11: map showing geo-located sources for Essex[16]



[16] http://www.british-history.ac.uk/analysis.aspx?p=1&t=m

Individual sources are labelled in abbreviated from in the left menu; accounts relating to individual parishes/towns within Essex are indicated by blue flags. Given the level of zoom, these flags will form first into green then yellow clusters depending on the density for a given area. For example, there are 10 locations in the Chelmsford area – clicking on the cluster zooms in to a sufficient degree to allow all the flags within that cluster to shown individually (see Figure 11).

The interface also contains controls to allow full screen viewing (see Figure 12 and Figure 13) which is of particular benefit to those with large monitors, and fuzzy searching on place names is also possible (Figure 14).

Figure 12: default display view of map

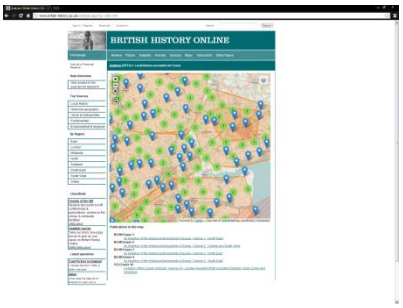


Figure 13: map at full screen

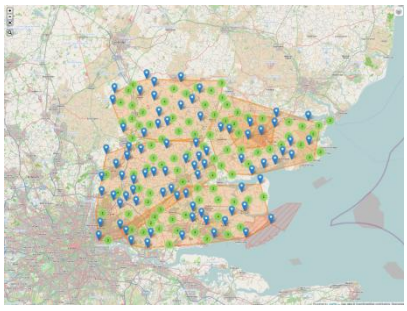


Figure 14: searching for a place within a map

Figure 15: links to individual articles from otherwise separate publications are co-presented

Place information was first drawn from publication metadata, then at the article level.

There were two aims for the mapping work-package: firstly, the successful triangulation of data from multiple largely modern geo-enabled APIs to ensure the accuracy of place names from sources which themselves can be

up to 200 years old; and secondly, a new mapping interface which would enable navigating between articles. The APIs used were:

- GeoNames (GN) http://www.geonames.org/export/web-services.html
- OpenStreetmap *Nominatim* (OSM) http://wiki.openstreetmap.org/wiki/Nominatim
- Wikipedia and DBpedia (WKP, DBP) https://github.com/dbpedia/lookup

Approach: prospecting, then sifting

We believed that almost all of the locations in the historic volumes would be in at least one and probably all three of the data stores. However, the spelling of the place name was liable to have changed between the original date of publication and now, meaning that calls to the API looking for an exact match on the historic version of the place name were liable to a higher chance of returning zero results.

Therefore, we would prepare our place names by trying to retrieve any synonyms and references to former counties from Wikipedia. This would also us to broadly query the two main data stores, GeoNames and OSM Nominatim, and then filter the (probably numerous) results rather than use precisely detailed queries which would either lead one or zero results.

Iterative rounds of API queries will be necessary, with the intention of improving the success of the next round. They will begin as exploratory and become increasingly precise.

Set up

The places from articles of publications dealing with the local history of Essex were extracted and stored along with its county in a separate data table. The earliest publication dated back to 1916 and we expected that the older the date of publication, the greater would be the potential mismatch with modern databases.

Counties also needed to be updated to modern nomenclature but their utility was also limited; for instance, West Ham was included in an Essex volume from 1921 although now it is located within the London Borough of Newham. A similar problem would arise south of the River Thames in what used to be a part of Surrey. Some counties will have been swallowed up by others, such as Huntingdonshire and Cambridgeshire, whilst others will have had much subtler changes in boundaries which would make the identification of the present county impossible before matching on the place name.

Place names themselves also have changed, often in subtle ways, for instance, *Abbot's Stapleford* is now commonly known as *Stapleford Abbotts*. Common prefixes such as High, Low, Great etc. were identified to enable a potential follow-up method of searching for the main part of place name.

One of the richest sources for mapping historic data to the present day would be to identify the relevant entry on Wikipedia for the place; this narrative source has the potential to be a useful source for synonyms, former spellings as well as former counties if places have been affected by boundary changes. In addition, Wikipedia has pages listing ancient parish names by county; however, smaller locations usually have nothing more than a holding URL.

Searching

Using the original place names, plus any variant spellings revealed through consulting Wikipedia, a loose request is made to the APIs from GeoNames and OSM Nominatim, i.e. *not* an exact phrase, just *all of the words*. The only other request variable sent is to return results from the United Kingdom.

The result sets are processed according to criteria which can be specific to the API. This may include particular categories such as “class=place” on OSM. The presence of the correct county names proved very useful albeit with the caveats listed above (there are 19 separate locations called Sutton within England). Finally, all results are compared to the original place name to give a Levenshtein edit distance such that we can recreate an environment in which we can choose the best match even when no direct match would be possible.

Once a selection is made, the unique node ID from GeoNames and OSM is stored – de-duplicating these at a later stage will help us to ensure that no two places has been mapped to the same point.

Extracting co-ordinates

Using the individual node IDs enables easy retrieval of the exact data via the API and both GeoNames and OSM Nominatim returned well-formatted responses in XML. Wikipedia and DBpedia will only return HTML responses for which regular expression work is necessary.

Triangulation

The latitude and longitude data from each place which has co-ordinate data from more than one source is now cross-checked using the Haversine formula with the rough expectation that the distance will be no greater than 2km. This is an area where intervention may be required as small parishes should be well covered by this tolerance but large towns less so. Where it exists, we look for data from OSM with the class of "place of worship" as this often links to the exact church around which an historic parish was formed.

Publishing

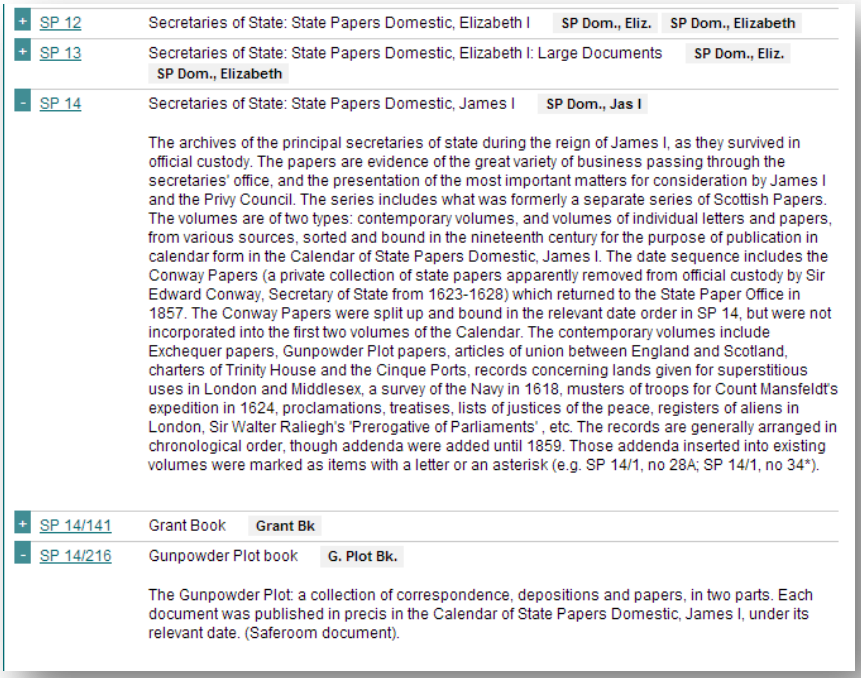
These locations, once approved, can now be made available for metadata inclusion, meaning that they can be applied to whole publications[17] or individual articles.[18] Places (with accompanying synonyms) can also be ordered into a hierarchy, used as word lists for text mining documents, and released in any number of geo-enabled formats for re-use through services such as GeoCommons[19].

National Archives reference look up

This tool will allow users to more quickly retrieve related information on original materials deposited at The National Archives. It will be of primary benefit to users of state papers on BHO, which are primarily in a calendar format, i.e. summarised versions of originals. In many cases the level of detail in the calendars may not be sufficient and users will want to seek access directly to the original manuscripts; they currently have no alternative other than to repeat their search on The National Archives (TNA) Discovery catalogue using an old system of referencing.

[17] http://www.british-history.ac.uk/browse.aspx
[18] http://www.british-history.ac.uk/analysis.aspx?p=1&t=m
[19] http://geocommons.com/overlays/365133

Figure 16: quickly look-up and link to a related reference in the National Archives. Note also the common forms of abbreviations used to describe the sources.



Data for source is taken directly from TNA via the catalogue API[20]; along with the title and description of the source, its modern ID number is also stored allowing a deep link from BHO to the exact record in the TNA. The data is stored locally to avoid unnecessary network traffic but an update function runs periodically to verify that no updates have been made to these records by TNA in the interim.

Potential future enhancements for this service include extending its coverage to the British Library, and the other commonly referenced heritage organisations and societies, and automatically extracting references from BHO sources and recovering their catalogue information automatically rather than manually choosing them.

Donations

This function will allow the project to test how effectively it can approach its audience for a charitable donation towards its maintenance and growth. With 85% of material completely free to view, and over 250,000 monthly visits, there is an opportunity to find out how such a campaign could be structured.

[20] http://discovery.nationalarchives.gov.uk/SearchUI/api.htm

Figure 17: sample message for appeal (1)

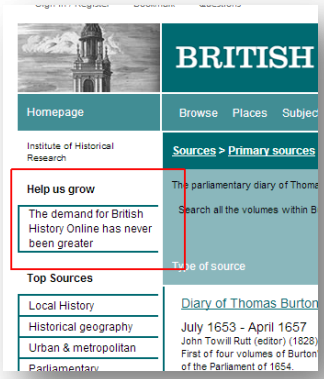
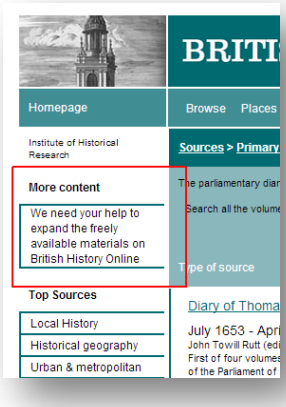


Figure 18: sample message for appeal (2)



Rather than using a bold design which would deliberately catch the eye, we opted for a prominent but subtle design displaying a very short message randomly selected from a set of 10. Click through on the advert would go to more information which would conclude with a donation call–to-action.

Evaluation techniques

Throughout the evaluation process we will use both quantitative and qualitative techniques to measure impact; this will enable a project to gain steady feedback both before and after developments, allowing a blended picture of performance to be derived. Rather than absolute figures like visitors or page views, a more nuanced approach is used for analytics and log file analysis which values depth of usage over amount of traffic.

None of the techniques in this section are drawn from Toolkit for the Impact of Digitised Scholarly Resources produced by the Oxford Internet Institute[21] as an examination of BHO using the toolkit was undertaken and reported on in 2011[22].

An index of sustainability: ISURV

This method of evaluation will investigate the creation of a sustainability index which will be the product of three variables: unique visitors, their return rate and the number of page requests per visit.

- **U**nique visitors: this is related to a number of factors, such as the uniqueness of the content, the longevity of the site, how it is promoted, and access fees.
- Rate of **R**epeat visits: a measure of how well suited the site is to visitors' needs, aka loyalty.
- Page views per **V**isit ('stickiness').

Thus our **I**ndex of **S**ustainability is the product of U × R × V. We can illustrate this through the example of a café: it can increase its business by getting more people through the doors (U), increasing the amount its customers spend each time (V), and improving the frequency with which each customer comes back (R).

In terms of resource allocation, the café has to decide which of these factors it could invest money in to bring it the biggest benefit; advertising to bring more people in (U), changing the product range or ambiance to increase money spent per visit (V), or the more diffuse aspects of loyalty (R) which could include more complicated activities such as taste tests or reward systems.

We'll begin by looking at the number of referrals to BHO from third party sites as given by Google Analytics. By removing all search engine traffic, we are left with a list of domain names, and the number of visits sent per month (see Table 19). Although we stipulate Unique Visitors in our formula, Analytics will only let us report Visits; however, the relationship between the two variables is constant throughout the year.

Table 19: referrals from English Wikipedia from April 2012 through to May 2013

Website	Period	U Visits from website	V Pages per visit	R % repeat visitors	U * R * V
en.wikipedia.org	2012-03	9,498	3.65	0.68	11,147
en.wikipedia.org	2012-04	9,300	3.66	0.67	11,228
en.wikipedia.org	2012-05	8,601	3.72	0.67	10,557
en.wikipedia.org	2012-06	8,097	3.75	0.67	9,872
en.wikipedia.org	2012-07	8,421	3.53	0.68	9,403
en.wikipedia.org	2012-08	7,562	3.77	0.68	9,010
en.wikipedia.org	2012-09	7,935	3.63	0.67	9,504
en.wikipedia.org	2012-10	8,936	3.70	0.67	10,927
en.wikipedia.org	2012-11	8,543	3.68	0.66	10,711
en.wikipedia.org	2012-12	7,639	3.86	0.67	9,853
en.wikipedia.org	2013-1	9,761	3.94	0.65	13,619
en.wikipedia.org	2013-2	8,959	3.73	0.65	11,730
en.wikipedia.org	2013-3	9,418	3.89	0.64	13,027

[21] TIDSR: Toolkit for the Impact of Digitised Scholarly Resources, Oxford Internet Institute http://microsites.oii.ox.ac.uk/tidsr/
[22] Blaney, Jonathan and Webster, Peter (2011) *The Impact and Embedding of an Established Resource: British History Online as a Case Study*: final report. http://sas-space.sas.ac.uk/2957/

en.wikipedia.org	2013-4	9,090	3.59	0.67	10,927
en.wikipedia.org	2013-5	8,187	3.39	0.65	9,757

Using data from all referring sites (on average, referral traffic to BHO comes from 2-3,000 separate domains per month), they can now be ranked by ISURV value (the top 20 are reproduced in Table 21). We can now make clear the distinction between ranking by visits alone and by ISURV figure by taking, for example the 10 top sites from May 2013 (see Table 20).

Table 20: difference in positions of referring sites based on ranking by visits or ISURV (May 2013)

Position	Ordered by most visits	Visits	Ordered by ISURV	ISURV	Difference in visits to ISURV
1	en.wikipedia.org	8,187	en.wikipedia.org	9,757	-
2	facebook.com	840	victoriacountyhistory.ac.uk	5,847	+1
3	victoriacountyhistory.ac.uk	819	history.ac.uk	2,799	+5
4	connectedhistories.org	659	english-heritage.org.uk	2,437	+6
5	en.m.wikipedia.org	501	connectedhistories.org	1,763	-1
6	m.facebook.com	493	elibrary.londonlibrary.co.uk	1,632	New
7	crabwallmanorhotel.co.uk	435	medievalgenealogy.org.uk	1,443	New
8	history.ac.uk	353	billdargue.jimdo.com	1,356	New
9	theanneboleynfiles.com	300	parliament.uk	1,328	New
10	english-heritage.org.uk	273	nationalarchives.gov.uk	1,123	New

In changing the sort sequence from aggregate visits to ISURV, sites such as Facebook or the popular blog 'The Anne Boleyn Files' are replaced in the rankings by more academic sites such as the London Library, the National Archives, and the Houses of Parliament. The evidence seems to indicate that using a metric based on sustainability can give us a clearer picture of BHO's position within the field made up of digital history sites. Using characteristics such as repeat visits and pages downloaded per visit alters our view from one based on performance to one based on longer term value.

Table 21: top 20 referring sites ranked by ISURV, June 2012 through May 2013

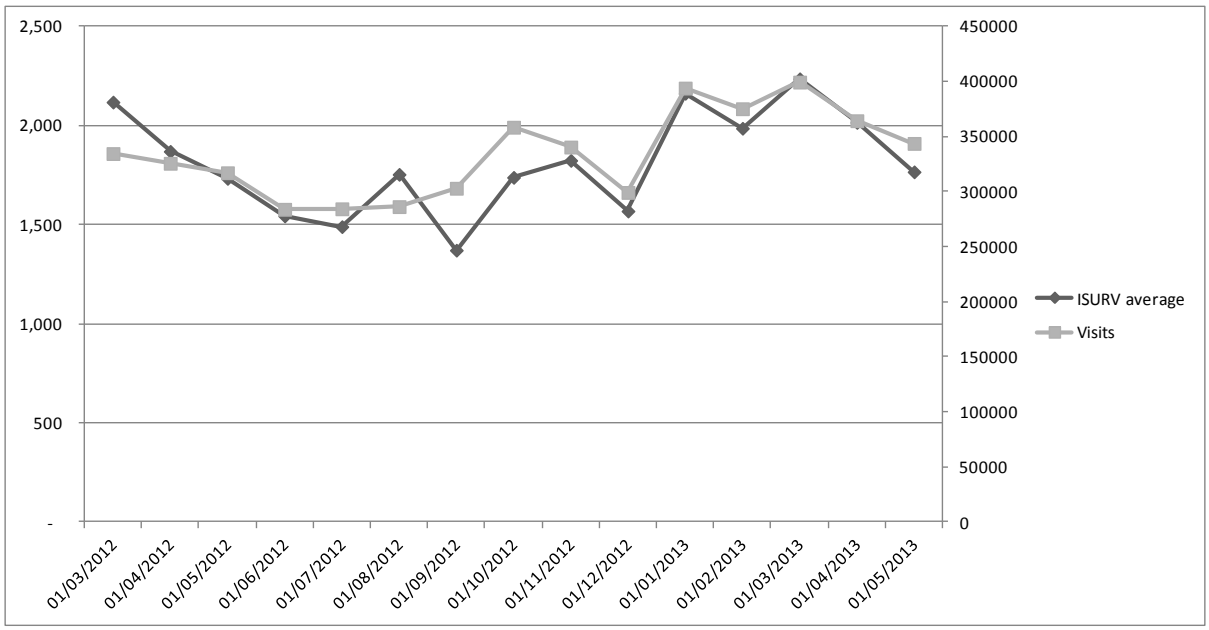
Referring site	2012 6	2012 7	2012 8	2012 9	2012 10	2012 11	2012 12	2013 1	2013 2	2013 3	2013 4	2013 5	Average
en.wikipedia.org	9872	9403	9010	9504	10927	10711	9853	13619	11730	13027	10927	9757	10751
victoriacountyhistory.ac.uk	4905	4875	6085	4403	6287	5693	4442	5930	6353	6469	5583	5847	5438
medievalgenealogy.org.uk	2663	3066	3830	1821	2392	2559	2551	2767	3265	2978	2511	1443	2784
connectedhistories.org	2077	2146	1825	1440	1829	1625	1393	2390	1952	3005	3232	1763	2091
history.ac.uk	1282	795	1323	1125	1322	1970	1892	2681	2635	3401	2452	2799	1940
english-heritage.org.uk	1291	1046	1569	1219	1350	2403	1808	1672	1806	1607	2698	2437	1706
billdargue.jimdo.com	1497	1303	2149	1316	1944	1453	1437	2616	1562	1460	2023	1356	1646
genuki.org.uk	1546	1548	1670	1300	1449	1629	979	1573	1620	1158	1299	944	1609
parliament.uk	810	405	1983	446	503	923	308	2364	1042	1601	2527	1328	1070
historyhouse.co.uk	922	744	764	1014	1059	1292	586	1003	1009	1241	1093	1102	1020
facebook.com	659	724	451	404	686	1001	1837	1455	1341	711	889	842	981
buildinghistory.org	524	504	962	972	385	559	1088	662	663	693	589	351	746
nationalarchives.gov.uk	232	275	418	342	950	892	904	708	794	1717	765	1123	695
eudocs.lib.byu.edu	245	138	207	255	1011	782	467	322	919	1218	689	715	687
elibrary.londonlibrary.co.uk	323	451	1038	265	291	341	288	758	569	1115	1036	1632	652
solo.bodleian.ox.ac.uk	318	769	211	56	446	805	420	813	520	1449	199	450	567
theanneboleynfiles.com	380	296	372	435	568	491	221	391	551	543	1035	791	523
oxfordsfx-direct.hosted.exlibrisgroup.com	276	301	159	290	562	501	99	745	724	356	396	279	460

visionofbritain.org.uk	684	563	463	361	478	469	384	409	426	462	95	106	439
pepysdiary.com	367	439	579	448	325	375	409	368	236	499	272	256	416

It is worth noting that Facebook is becoming a steadily large source of sustainable traffic – looking at Facebook Insights for May 2013, there were 248 distinct links to BHO created across all public and private communications, which were seen 7,892 times (a multiplier of 32). These generated 1,778 referrals to BHO, an impressive click through rate of 23%. Twitter, by contrast, has an ISURV average of 108 for the same period as Table 21, giving it around one tenth of the value of Facebook.

With data indexed by date, we can now look at how these figures change throughout the calendar year, to see if we can identify anything resembling an academic year (see Figure 19). We can clearly see the summer dip from April through to September, following by an increase around the autumn term, a slowdown over Christmas, and a rapid uptick in usage for the first three months of the year. Although clearly related to the aggregate number of visits to BHO as a whole, it appears to be more sensitive to the academic year, showing a clear divergence around the autumn term and the month of August when we could postulate that many academics are preparing work during the holiday period.

Figure 19: average ISURV value for top 20 referring sites with number of aggregate visits to site (March 2012, through May 2013). Left axis: visits, right: ISURV.



System usability scale

At the heart of all digital services is the aim of providing information support for people who would otherwise find it harder (perhaps impossible), more time-consuming or more expensive to get that support elsewhere. Services are inherently user–centred and context-dependent which makes it hard to measure, let alone compare, the impact of resources.

The system usability scale (SUS)[23] was developed in response to the need to quickly measure the effectiveness across industrial systems contexts and is designed to be 'quick and dirty'. It is a questionnaire with 10 items each with five scale answers (see Table 22), the wording of which alternates between positive (odd numbered) and negative (even-numbered).

[23] Brooke, J. (1996). "SUS: a "quick and dirty" usability scale". In P. W. Jordan, B. Thomas, B. A. Weerdmeester, & A. L. McClelland. Usability Evaluation in Industry. London: Taylor and Francis.

Table 22: standard version of the System Usability Scale

		Strongly agree				Strongly disagree
1	I think that I would like to use this system frequently	○	○	○	○	○
2	I found the system unnecessarily complex	○	○	○	○	○
3	I thought the system was easy to use	○	○	○	○	○
4	I think that I would need the support of a technical person to be able to use this system	○	○	○	○	○
5	I found the various functions in this system were well integrated	○	○	○	○	○
6	I thought there was too much inconsistency in this system	○	○	○	○	○
7	I would imagine that most people would learn to use this system very quickly	○	○	○	○	○
8	I found the system very cumbersome to use	○	○	○	○	○
9	I felt very confident using the system	○	○	○	○	○
10	I needed to learn a lot of things before I could get going with this system	○	○	○	○	○

If we see good usability as being an essential characteristic for sustaining usage for digital services, then we can benchmark users' subjective opinion of a service's performance (and compare it to other services) using the SUS. The SUS was installed on BHO and new users were invited to participate the month after they had registered, and users who had previously registered and were recently active were also invited (see Table 23).

Table 23: SUS responses per month. As the data is not symmetric, 1000 samples are drawn from each month's responses creating an average with a central tendency

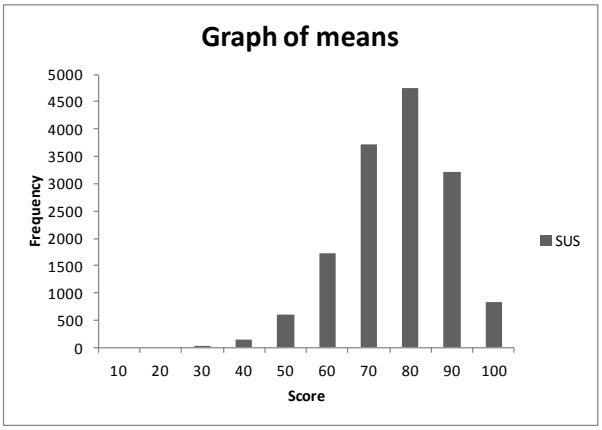
Year	Month	Completed surveys	Average score	Standard deviation
2012	**3**	39	71.16	14.086
2012	**4**	107	75.12	10.789
2012	**5**	116	73.02	10.963
2012	**6**	92	71.25	14.061
2012	**7**	107	74.00	11.920
2012	**8**	52	73.37	13.001
2012	**9**	75	71.18	11.686
2012	**10**	57	72.94	12.400
2012	**11**	68	76.70	11.584
2012	**12**	51	69.80	10.323
2013	**1**	67	72.30	11.687
2013	**2**	77	69.65	13.220
2013	**3**	63	73.43	12.471
2013	**4**	68	73.50	12.499
2013	**5**	80	69.90	10.889
			72.49	*12.306*

Whilst there does not seem to be much association between scores and the academic calendar, the average scores are fairly well packed together from 69 through 76. This gives us an average figure overall of 72.49 based on monthly splits; to check this, we bring together all of the mean scores into brackets of ten (see Table 24) in which the bracket of 71-80 is the most populous – this demonstrates why our approach of calculating means from samples provides additional analytical insight if the data itself is asymmetric.

Table 24: histogram showing central tendency to SUS scores

Score	Frequency
0-10	0
11-20	0
21-30	20
31-40	146
41-50	595
51-60	1,733
61-70	3,713
71-80	4,749
81-90	3,205
91-100	839

Figure 20: graph of 1,000 SUS means per month (15)



There is very little public data from SUS research in digital humanities so it is only possible to use data from across different fields in order to benchmark the scores (see Table 25). This reveals it to be well-placed with regards to other web services, being four points higher with a lower standard deviation.

Table 25: SUS scores by type of user interface (minimum 50 surveys) [24]

Type of Interface	Count	Mean	St Dev.
Cellular phone interfaces	189	66.55	19.84
Customer premise equipment (e.g., phones, modems, etc.)	219	71.60	21.60
Graphical user interface for OS-based computer (non-Web)	208	75.24	20.77
Interactive voice response phone systems, including speech based (IVR)	401	73.84	22.15
Web-based	1,180	68.05	21.56
Combined Web/IVR	50	59.45	19.19
British History Online, March 2012 to May 2013	1,119	72.34	17.24

Beyond its absolute level, the SUS device is most suited to testing impressions before and after developments in an environment or situation without access to usability laboratory or equipment. As such it can scale well, is not limited to location, and represents a small amount of time in addition to that taken for user testing. It provides a low cost method of showing that improvements have been made to interfaces as it can be repeated throughout the development process.

The BHO version of the SUS contained an eleventh question, 'Overall, I would rate the user-friendliness of this website as...', and one answer could be selected from the following list: Worst imaginable, Awful, Poor, OK, Good, Excellent, Best imaginable. This question was added to triangulate the quality of the responses; with no known application of the SUS currently in the field, it would be impossible to say that a score of 70 was a good or bad figure. For the score to be of any use in justifying action (i.e. redevelopment), then it is essential to know where on the qualitative spectrum scores lie.

By splitting responses according to the adjectival rating, we can see that in all average scores for each rating are in the exact order which you would expect them. Whilst the scores themselves vary from month to month, their sequence always matches the rating scale (see Table 26) with only one exception.

Table 26: SUS average scores per month for each rating

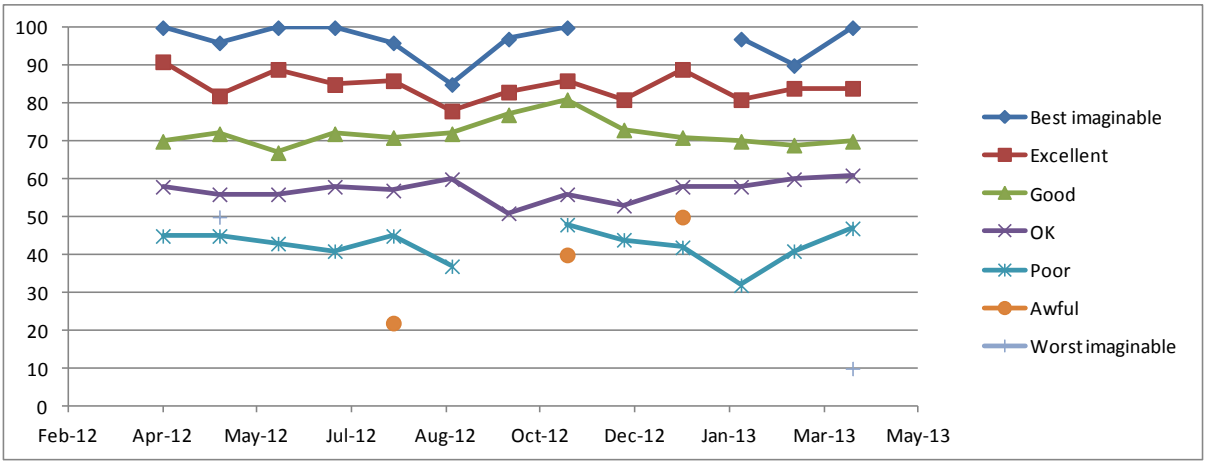
Rating	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13
Best imaginable	100	96	100	100	96	85	97	100	-	-	97	90	100
Excellent	91	82	89	85	86	78	83	86	81	89	81	84	84
Good	70	72	67	72	71	72	77	81	73	71	70	69	70

[24] Source: Bangor, Aaron, Philip T. Kortum, and James T. Miller. "An Empirical Evaluation Of The System Usability Scale." *International Journal Of Human-Computer Interaction* 24.6 (2008): 574-594. Academic Search Complete. Web. 12 Mar. 2013.

OK	58	56	56	58	57	60	51	56	53	58	58	60	61
Poor	45	45	43	41	45	37	-	48	44	42	32	41	47
Awful	-	-	-	-	22	-	-	40	-	50	-	-	
Worst imaginable	-	50	-	-	-	-	-	-	-	-	-	-	10

In some months, there were no responses received for every adjectival rating; for instance, in December 2012, there were no respondents who classed the user-friendliness of the site as either best imaginable, awful or worst imaginable. We cannot represent these data points as zero, as that would imply that responses had been received for that category. Therefore when we graph out the adjectival ratings in Figure 21, we see that some data series appear broken.

Figure 21: SUS averages by adjectival rating

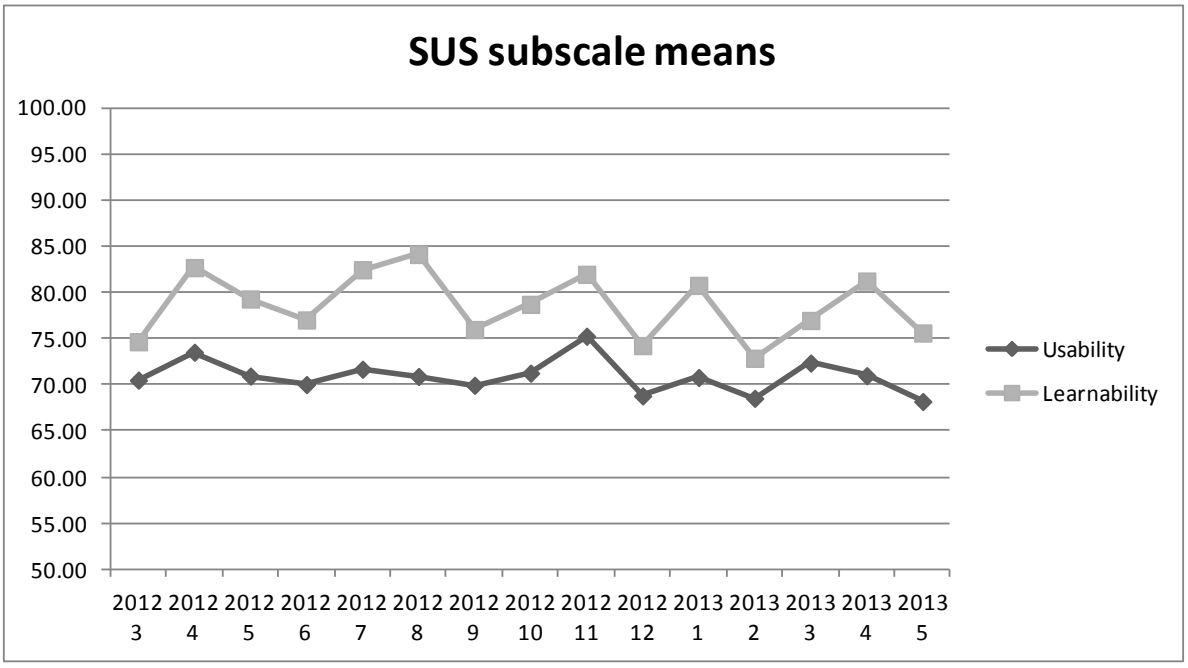


In almost all cases, the data series themselves do not cross, showing that the first 10 items in the standard SUS questionnaire are effective at identifying the subjective rating of the user. However, since an SUS score is not a percentage as such, it will still be necessary to keep this 11th question to benchmark the scores to the actual efficacy of the system.

Furthermore, recent research[25] has confirmed that the original 10 items can be subdivided into 8 usability questions and 2 related to *learnability*, a characteristic of digital services which measures how easy they are to use the first time. By splitting items 4 and 10 into this new category, scores for both categories can be calculated using the same dataset (see Figure 22). However, the exact correlation between these two subscales will depend on the nature of the service itself; systems which enable, say, document editing will take longer to learn than one which enables navigation between and display of the documents.

[25] 'On the dimensionality of the System Usability Scale: a test of alternative measurement models' Simone Borsci, Stefano Federici, Marco Lauriola. Cognitive Processing, August 2009, Volume 10, Issue 3, pp 193-197 http://dx.doi.org/10.1007%2Fs10339-009-0268-9

Figure 22: means from the Usability and Learnability subscales



Navigation patterns

Typically, an academic digital resource enables access to assets such as articles, images, and sound or video clips. The resource will also contain one or a number of different ways to access that content; for instance, there may be a text search function, listings based on metadata like subject or individual, a map showing items spatially or perhaps a timeline showing material chronologically. The success of each of these types of navigation can be judged by comparing their overall popularity with the number of visitors who actually follow a link from the navigation device to the target content itself.

Table 27: the efficacy of BHO different navigation techniques (Week 25, 2013)

Navigation	Visitors who browsed and/or searched [A]	Visitors who clicked through 'success' [B]	% clicked through [C]	Visitors who only browsed or searched, not both [D]	Visitors who clicked through 'success' [E]	% clicked through [F]	Visitors who both browsed and searched [G]	Clicked through 'success' [H]	% clicked through [J]
Browse	4,851	1,612	33.23%	3,098	937	30.25%	1,753	675	38.51%
Period	561	132	23.53%	371	78	21.02%	190	54	28.42%
Place	2,478	938	37.85%	1,533	535	34.90%	945	403	42.65%
Subject	1,812	542	29.91%	1,194	324	27.14%	618	218	35.28%
Search	4,954	2,934	59.22%	3,572	2,063	57.75%	1,382	871	63.02%

Using the example of this from BHO given in Table 27, we can see from column [A] that there is quite an even split between the numbers of people using listings and search, suggesting that users have no strong preference for one of these types of technique over the other. However, once we take into account column [D] we see a striking polarisation: over 70% of users who search do not use browsing; although that ratio is lower for browsers who never search (64%), this does seem to suggest that the majority of users are intent on only using one technique in a single session.

This could be considered a behaviour trait of users about which projects can do very little; however, when we compare the success rates between those that use either browsing or searching (column [F]) with those that use both (column [J]), we see success rates that are 27% higher for browsing, and 9% higher for searching. There appears to be an amplifying effect on impact if users can be encouraged into using more than one navigational technique.

Potential methods to encourage this fidelity of use might be to create faceted browsing of search results using metadata with links therein, filtered searching of content from within a specific listings category, and the creation of tutorials in which this blended approach is presented.

Completion rates

During Week 42 of 2012, the mapping interface for local history publications was launched. We wanted to investigate whether there had been a significant change in the standard completion rate for the browsing function where the map was located. Data from the previous 16 weeks was selected ('Before;) and compared to data from the following 16 weeks ('After') starting from week 43 to avoid any bias from the announcement of the new function in week 42 itself.

Selection	Success	Attempts	Proportion
Before	2,747	20896	0.131
After	3,283	21616	0.152
		P	0.142
		Q	0.858
		z	6.032233548
			1.61709E-09
		Difference	0.020
			0.006624791

The 95% confidence interval is 0.014 to 0.026: we are 95% confident that the actual improvement is between 1.4% and 2.6 %

Focus groups

During 2013, we conducted two follow-up user groups to test the effectiveness of the networking and mapping tools, one with librarians drawn mostly from the Senate House Library at the University of London, and one from graduate librarian trainees, pulled from several academic institutions across London. Their responses to each tool are shown together (see Table 28 through Table 31) to best illustrate any differences in perception.

Table 28: matrix of subjective feedback on *Networks of people* from focus groups

University of London librarians	Graduate trainees
Defined as appearing together in the same section How it was made wasn't clear. A worked example would be ideal for the first-time user Useful for the History of Parliament where they are looking for biographies. Technical note – iPad has no 'hover' event and some participants could not see the names in the diagram Was not clear that you could drag nodes. Best used at the start of a project – a starting point for supervisors. When they reach the library they are already 'stuck'. Perhaps users could upload their own list? Potentially useful. Download the diagram as a GIF/JPG with citation. Download the data for further analysis in, say, Excel or SPSS. Build up results from several sources. Perhaps a course in 'just enough excel' Videos were a useful lightweight method of providing training for software; done at different levels they could be used to build experience over time.	Really quick identification Reminded participant of maps of the blogosphere (blogs referencing other blogs); otherwise not seen example before elsewhere Participants knew of no tools currently in operation for data mining.

Table 29: matrix of subjective feedback on *Local history maps* from focus groups

University of London librarians	Graduate trainees
Need a link to area on map from list of publications beneath Footnotes – links to Victoria County History (VCH) and back from Royal Commission on Historical Monuments of England (RCHME) + OS maps Intuitive – the symbols used were clear and it resembled common Google Maps The map was tidier without detailed information Layers worked fine and were easily understood Need a button to reload the initial view. Technical note – tablets did not respond to Full-Screen command Pressing return fired site search – need to disconnect. Using search, it was not clear you have to click on a result. Map needs to cover ALL local history resources.	Not much use of mapping in catalogues or discovery tools at the moments. Map thought to show monuments (Note: RCHME volumes formed bulk of mapped data), or local history account 'mentions'. Search faltered twice – did not work at all in Full Screen mode; and several users hit enter before noticing search used the 'auto-complete' model Participants would have used site text search if they already knew a place name. A map would be useful for knowing the environs/ breaking out from current research. The links were not descriptive enough; perhaps a table of content from the article could be included. Prefer the map without overlays of photographs/images – point was to give a rough overview and an understanding of context. Images weren't really necessary for this. Map could include more about individual monuments, at least their names. Could use the left-hand sidebar as an interactive caption, like Google Maps. Need a 'home' button to reload the initial view.

Table 30: matrix of subjective feedback on *Heading indices* from focus groups

University of London librarians	Graduate trainees
Technical note – tablets do not have hover – affects the numbering in the graph which is only revealed when the hover event is triggered. May want to search wider than one volume Position of hyperlinks to filter and search are opposite to previous example Heading could show list of components Does give a sense of when things are discussed. Giving a count is useful – can be a little surprising.	Factiva could show graphs as well as tables Prefer a longer view for broader topics – perhaps decades with option to refine down by year. Would look at the similarity between topics based on date pattern if that could be shown. Not clear what the link on document count does. Thought to be useful for political history.

Table 31: matrix of subjective feedback on *Heading similarity* from focus groups

University of London librarians	Graduate trainees
There was difficulty understanding the function and a full explanation was given. Agreed that using this way was not useful. However, it was enough to communicate the nature of the function and the function did sound interesting – just not in this context. Wordings of bills do vary in a way in which keyword searching may not be efficient as there are so many variations. Bigger the sources, the greater the chance of getting better results.	Zero prior experience of this tool Library catalogues do have a 'Your query would appear here' lookup though that relies on the first characters being shared The *Close* function offered by the Cardiff Index to Legal Abbreviations was thought to offer similar functionality

Moderator's reflection

Of the four functions presented, only the headings similarity tool failed to impress the focus groups; whilst they understood the nature of the tool they were not sure that this was the most appropriate use for the concept behind it; it may function better if it were used over a much wider corpus where the variance in spellings would be more acute.

During their group, the librarians took a reflective approach and thought through how they would explain the value of each function to their readers. They made many practical suggestions for each function and were able to

justify them using insight into readers' behaviour. In so doing, they gave a qualitative assessment of the *learnability* of the product.

In contrast, the graduate trainees were more direct in their use of the tools and drew on their own first-hand experiences of software products; their evaluation of the functions centred on their immediate efficacy as information devices. The mapping tool in particular drew a lot a feedback which tumbled out without the moderator's intervention; this group appeared to be more naturally focus on the *usability* of the new developments.

Using multiple focus groups from different constituencies appears to enable the project to acquire qualitative feedback which will align with the subscale measures of the SUS. The project is then able to check each measure on an ongoing basis via the survey, with a periodic focus group to look at new developments or identify current problems. By combining these two feedback techniques, the definition of the impact of a digital resource can be made more sophisticated and sustained over time.

Conclusion

Whereas a metric like income or revenue can be quantified, it is much harder to unpack the components of sustainability – it seems to cover several areas such as economic, social and technical. It appears to be closely related to the concept of risk; the fewer the risk mitigation strategies a project employs, the lower the chance that the project will survive. It could be defined as the management of risk such that the service's outcomes are delivered now and into the future.

Whilst it is important to follow best practice within the field in areas such as security, technical benchmarks, and the quality of content, we also need to *act* sustainably. Rather than a product, sustainability is a process and it can be argued that acting sustainably will help to avoid any future breakdown of standards by counterbalancing the risk of projects to treat best practice guidance as a box-ticking exercise.

However, if you define digital services in this way, then do you detect sustainability? Can it be objectified in such a way that it can be taught or shared? Finally, is measurement of it even possible? And if not, then surely no financial value or reward can be attached to it.

The idea of sustainability differs from system usability in one important aspect: with usability, you can monitor and look out for failings, fix something and then evaluate how successful you've been. Here a problem exists and is fixed; but with sustainability, changes may lie farther afield – it may be legislative (such as the Cookie Law impacting on advertising revenue), budgetary (such as the impact of the current Comprehensive Spending Review) or technical (such as the rise of apps for GPS-enabled mobile devices creating new customer expectations).

With such an interpretation of the term sustainability, it becomes harder for managers of digital services to justify and implement changes designed at improving conditions for sustainability if the benefits can only be felt much further down the line. Effort is employed in doing more of a project's current activities where the benefit is more closely felt and easily measured, rather than implementing changes to, say, working practice.

Where we see failings in digital services, such as recently with the BBC Digital Media Initiative, we can often attribute them to poor leadership or a lack of resources (which can lead to de-motivation). It doesn't mean that the services were destined to fail; more that they were built in such a way as to be failure-prone. Sustainability can be usefully seen as an *approach* to service development rather than any one fixed characteristic.

Common business intelligence techniques, such as calculating quantitative visitor numbers or qualitative SUS scores, are effective methods of ensuring that crucial technical or editorial tasks are carried out without needing to assess the complex issue of sustainability.

Priority should be given to the sound knowledge of technical possibilities, user needs, and organisational outcomes. It is important to define up-front what measurement framework we will use because this will make it possible to communicate and recover the decision-making process and the results obtained.

When it comes to the production and hosting of new significant pieces of content, most users are less interested in the exact technology used, and are more concerned with whether it is going to persist and be citable over the long term. To inform that kind of decision, it is important to see a digital service provider's track record of *sustainable* outcomes, i.e. projects which have listened to user feedback and evolved over time, rather than focussing on the initial delivery phase of a project.

Users may also be somewhat suspicious of big aims; being responsible for British History Online for over 10 years, I've lost count of the number of times when people have passed negative judgement on the ability of us to deliver to such a title. Users really don't want some kind of mouthpiece for their opinions; they just want the product they need. So abstract/complex issues such as sustainability which do not have much direct relevance to them may be treated with something approaching contempt in some parts.

The more unstructured the focus on our users is, the more likely our actions as service providers could be insular or superficial; the service that spends all its time listening may be overwhelmed by the quantity and complexity

of responses which it receives – there are thousands of different combinations of reports available just through Google Analytics – so a sense of distance and objectivity is required in order to maintain these services.

So, how do we navigate between box ticking on one side, and the difficult to define area of sustainability on the other? Can we create services which eclipse those in the private sector?

We need services which can deliver on both fronts: technically competent service providers who can also demonstrate sustainability. Running surveys or checking reports do not need to be objective tasks themselves – they can be performed in open ways, such as appealing for volunteers, providing progress updates, publishing the results, and inviting feedback. Each user contact point becomes an opportunity for learning.

Knowing your strengths and weaknesses is important as this will help to build together a team not just of different technical specialisations, but also who can deliver the balanced approach which a projects needs to become sustainable. It is hard to project a deep respect for users if the team behind it cannot maintain good relationships within its own environment; this is what motivates the first Agile principle of valuing individuals and interactions over processes and tools.

The technical time taken to deliver a product can be quite small compared to the amount of time taken to listen to user feedback and understand people's needs. It is clear that if users know that their views are being listened to, that they will think more positively of the project – people's needs and their priorities change and if we want to maintain the quality of our relationship with users, then we, as service providers, need to have constant collaboration with users over the course of the project (see Agile principle 2).

Take this example of survey feedback regarding trust: '*I have no reason to disbelieve the figures, which come from an apparently reliable source.*' The user wants us to see things from their perspective; they want us not to be terse or lofty but to take time to listen to what they are saying. These are conditions of which service providers can make a lot more; the impact of users being able to trace the impact which they have made to a project will result in a more engaged audience and even positive 'word of mouth' referrals. Dividing projects into products in which users' feedback is acted upon is embodied in the fourth Agile principle of responding to change.

With this modular approach in mind, an information service becomes unlikely to have ever been designed as a complete whole. This makes it harder to predict its final form, and therefore tougher to gain initial managerial approval. Yet, sustainability may still depend on factors outside of the service developer's control – strategies or priorities may be changed and budgets may be cut. This makes it necessary to represent the outer environment around the digital service to give it the chance of learning and adapting to influences which are beyond its focus.

The modular and iterative approach also makes it harder to create a clear statement of purpose for the system – if the environment in which it operates changes, then that statement may become invalid. Clearly, a service which has an existing interface with its environment will be in a better position to respond to changes. Furthermore, the agile project will be showing steady progress by delivering working software which itself could be used to publicise its work and gather influence more widely, thus influencing its environment during development.

Using this frame, the discipline of project management becomes a part of development process but by no means the most important; following best practice and the principles of PRINCE II can increase the chance of delivering something but it cannot tell you what that something is. It is a tool to be used throughout development but it has no ordinal place within a service; at times, tools such as scenario planning, information modelling or risk analysis may be more crucial to the service's longevity.

Furthermore, a programme of user focus / feedback cannot easily be bought in – it has to be developed from within the digital service otherwise relationships with users will not persist. As such, building a sustainable product on the back of user focus requires a systemic approach to development, one which relies on the interaction of technology, staff and senior owners, and the users. The sustainability of a service could then be defined as the institutionalised response to supporting this trinity over time.